

# **Draft determination of causer: 26 July 2024 under-frequency event**

Consultation paper

10 April 2025

## Executive summary

The normal frequency band in New Zealand is between 49.8Hz and 50.2Hz. An under-frequency event occurs when the frequency band falls below 49.25Hz because of a loss of injection of more than 60 megawatts (MW) into the grid. The Electricity Industry Participation Code 2010 (Code) requires the Electricity Authority Te Mana Hiko (Authority) to determine the causer of an under-frequency event and sets the process for making the determination.

At 7:21am on 26 July 2024, an under-frequency event occurred when 231MW of generation injection was interrupted or lost at the Clyde grid connection point. This resulted in a drop in frequency to 49.14Hz in the South Island.

The Authority's draft determination is that Transpower as grid owner is the causer of this under-frequency event because:

- the interruption of energy injected into the grid occurred at Clyde power station units 2 and 3, which belong to Contact Energy Limited (Contact)
- Contact and Transpower as grid owner share use of the same direct current (d.c.) secondary power supply at the Clyde generation station and grid connection point
- the Contact generation assets tripped due to a 125V d.c. earth fault on a grid owner's disconnecter located at the Clyde grid connection point. This introduced an incorrect protection signal that triggered Contact's 220kV primary protection system and tripped Clyde generating units 2 and 3
- in the system operator's view, Transpower as grid owner is the causer of the under-frequency event.

Transpower does not accept that it was the causer.

Contact Energy does not accept that it was the causer.

Clause 8.61 of the Code requires the Authority to consult with generators, the grid owner and other participants who may have been substantially affected by this under-frequency event on the reasons for its draft determination.

Affected participants are invited to make a submission by 5pm on 13 May 2025. The Authority will consider all submissions and then make its final determination.

We also invite comment on the system operator's calculation of the megawatts of power lost during the event, which the system operator uses for calculating the under-frequency event charge.

## Contents

<b>Executive summary</b>	<b>2</b>
<b>1. What you need to know to make a submission</b>	<b>4</b>
What this consultation is about	4
How to make a submission	4
When to make a submission	4
The Authority will consider submissions and make a final determination	4
<b>2. Introduction</b>	<b>5</b>
<b>3. The 26 July 2024 under-frequency event draft determination</b>	<b>5</b>
The system operator investigated the causer of the under-frequency event	5
The Authority considered the circumstances of the under-frequency event	6
<b>4. The system operator has calculated the MW lost during the event based on its investigation</b>	<b>7</b>
<b>Appendix A Format for submissions</b>	<b>9</b>
<b>Appendix B System operator causation report 26 July 2024 under-frequency event</b>	<b>10</b>
<b>Appendix C Interpretation of causer</b>	<b>43</b>

# 1. What you need to know to make a submission

## What this consultation is about

- 1.1. This paper consults with every generator, grid owner and other participant substantially affected by the under-frequency event that is the subject of the Authority's draft determination. The draft determination is that Transpower, as the grid owner, was the causer of the under-frequency event at 7:21am on 26 July 2024.

## How to make a submission

- 1.2. The Authority's preference is to receive submissions in electronic format (Microsoft Word) in the format shown in Appendix A. Submissions in electronic form should be emailed to [compliance@ea.govt.nz](mailto:compliance@ea.govt.nz) with 'Consultation paper – 26 July 2024 under-frequency event' in the subject line.
- 1.3. If you cannot send your submission electronically, please contact the Authority ([compliance@ea.govt.nz](mailto:compliance@ea.govt.nz) or 04 460 8860) to discuss alternative arrangements.
- 1.4. Please note the Authority intends to publish all submissions it receives. If you consider that the Authority should not publish any part of your submission, please:
  - (a) indicate which part should not be published,
  - (b) explain why you consider we should not publish that part, and
  - (c) provide a version of your submission the Authority can publish (if we agree not to publish your full submission).
- 1.5. If you indicate part of your submission should not be published, the Authority will discuss this with you and make any necessary redactions before publishing.
- 1.6. All submissions received by the Authority, including any parts that the Authority does not publish, can be requested under the Official Information Act 1982. This means the Authority would be required to release material not published unless good reason existed, under the Official Information Act, to withhold it. The Authority would normally consult with you before releasing any material that you said should not be published.

## When to make a submission

- 1.7. Please provide your submission by 5pm on 13 May 2025.
- 1.8. Compliance staff will acknowledge receipt of all submissions electronically. Please contact us via [compliance@ea.govt.nz](mailto:compliance@ea.govt.nz) or 04 460 8860 if you do not receive electronic acknowledgement of your submission within two business days.

## The Authority will consider submissions and make a final determination

- 1.9. The Code requires the Authority to consult with every generator, grid owner and other participant substantially affected by an under-frequency event in relation to a draft determination. The consultation period is 20 business days.
- 1.10. The Authority will consider submissions received and publish its final determination.
- 1.11. The Code sets out provisions relating to any disputes regarding the Authority's determination. These requirements and provisions are in clause 8.62 of the Code.

## 2. Introduction

- 2.1. Under clauses 8.60, 8.61(2) and 8.61(3) of the Code, the system operator is required to investigate the causer of an under-frequency event and provide a report to the Authority. The Authority must then publish a draft determination that states whether an under-frequency event was caused by a generator or grid owner, and, if so, the identity of the causer. The draft determination must include reasons for the findings.

## 3. The 26 July 2024 under-frequency event draft determination

- 3.1. The Authority's draft determination under clause 8.61 is that Transpower, as the grid owner, is the causer of the under-frequency event at 7:21am 26 July 2024.

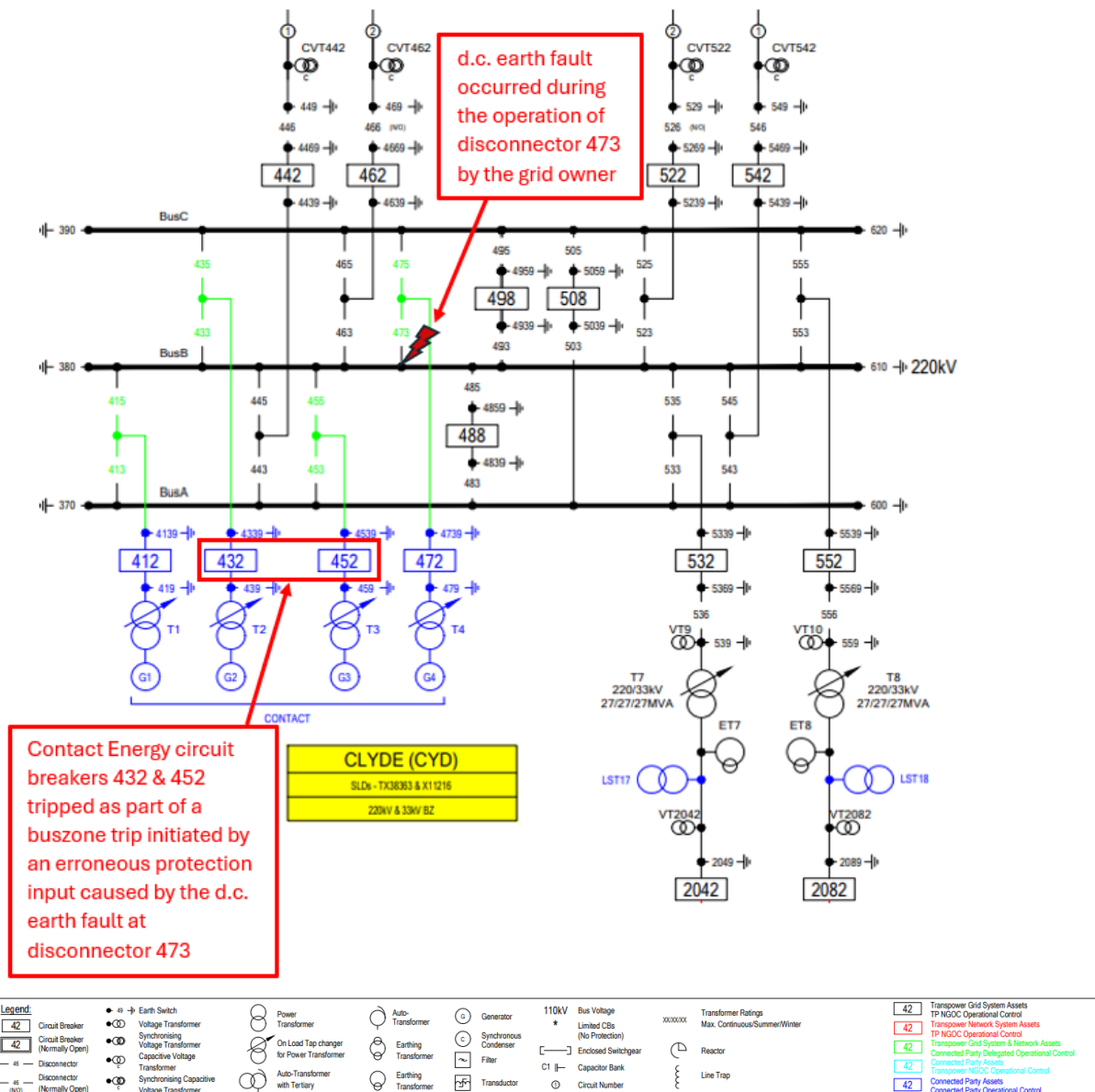
### **The system operator investigated the causer of the under-frequency event**

- 3.2. The system operator's report (dated December 2024) is attached as Appendix B.
- 3.3. The circumstances described in the report are summarised below:
  - (a) At 7:21am 26 July 2024, Clyde Units 2 and 3 tripped removing 231MW of generation.
  - (b) South Island frequency fell to 49.14Hz.
  - (c) The frequency fall and the quantity of MW lost (greater than the 60MW minimum) meant that an under-frequency event, as defined in Part 1 of the Code, had occurred because there was an interruption or reduction of energy injected into the grid.
  - (d) Instantaneous reserve providers in the South Island responded, returning the frequency to the normal band within twelve seconds.
- 3.4. Clyde Units 2 and 3 tripped due to a 125V d.c. earth fault on a grid owner's 220kV disconnector (473) located at the Clyde (CYD) 220kV grid connection point. This generated a capacitive current discharge through a (200-300m) d.c. signal cable to Contact's primary protection relay and caused this protection relay to trip Clyde generation units 2 and 3.
  - (a) no other event or asset operation was identified as occurring at or around the time of the under-frequency event.
  - (b) on 5 August 2024, the system operator requested the grid owner provide information on the circumstances of the under-frequency event and also requested it provide information on its assessment of whether or not it was the causer of the under-frequency event.
  - (c) on 5 August 2024, the system operator wrote to Contact requesting it provide information on its assessment of whether or not it was the causer of the under-frequency event.
  - (d) on 9 August 2024, the grid owner provided its assessment of the under-frequency event. The grid owner does not believe it was the causer of the 26 July 2024 under-frequency event.
  - (e) on 9 August 2024, Contact, provided its assessment of the events leading to the under-frequency event, stating it does not believe it caused the under-frequency event on 26 July 2024.

## The Authority considered the circumstances of the under-frequency event

3.5. The Authority has considered the system operator’s report and correspondence with Contact and the grid owner. The Authority’s reasons for the draft determination that Transpower, as the grid owner is the causer are:

- (a) an under-frequency event occurred at 7:21am 26 July 2024 when frequency dropped to 49.14Hz in the South Island when Contact’s Clyde units 2 and 3 tripped.
- (b) the system operator’s investigation into the tripping event and other system events found that planned operation of a grid owner disconnecter (473) at the Clyde (CYD) 220 kV grid connection point caused a direct current (d.c.) earth fault on the d.c. power supply system feeding both the 220kV duplicate protection system at the CYD 220 kV grid connection point and also the Clyde power station 220kV primary protection system. The lengthy signal cabling at Clyde introduced an erroneous protection signal that led to the triggering of the primary protection system and tripping of Clyde generating units (G2 and G3), resulting in an under-frequency event in the South Island.



- (c) Contact operates its d.c. power supply at Clyde in close proximity to its 220kV protection relays and provides the grid owner with access to this d.c. supply for use at the Clyde grid connection point located 200-300m from the d.c. supply location.
  - (d) Contact's protection configuration and settings of its circuits connected to the secondary d.c. supply reflected the close proximity of the d.c. supply to its relays.
  - (e) the grid owner applied a different protection configuration and settings of the secondary d.c. supply to Contact to reflect the potential capacitive discharge effect of an earth fault where the signal cables are long (200-300m) including;
    - high burden resisters
    - pull down resisters
    - debounce settings of 5ms (milliseconds)
  - (f) both parties had not communicated or standardised their respective secondary system protection settings with the other party.
  - (g) the grid owner has confirmed that the d.c. earth fault was caused by a flaw in the build quality of the flexible wiring connection of the 220kV disconnecter (473) motor owned by the grid owner.
  - (h) the earth fault changed the d.c. system reference voltages, causing capacitive current discharge in the signal cable which activated the primary protection relay erroneously causing the Clyde units 2 and 3 to trip.
  - (i) in accordance with the interpretation of "causer" in Part 1, clause 1.1(1) of the Electricity Industry Participation Code 2010 (Appendix C), if an interruption or reduction of electricity from a single generator's asset is caused by the grid owner's assets, the 'causer' in relation to that under-frequency event is the grid owner
- 3.6. A previous occurrence of an under-frequency event involving a shared d.c. supply (causing erroneous protection inputs) between a generator and the grid owner (13 December 2011) and the grid owner acknowledged that it was the causer in that case.
- 3.7. The Authority agrees with the system operator's findings on the causer of the 26 July 2024 under-frequency event having considered the relevant clauses of the Code and based on the information available at this time.

Q1. Do you agree with the draft determination that Transpower New Zealand Limited (Transpower), as the grid owner is the causer of the under-frequency event on 26 July 2024 at 7:21am? If not, please advise your view on the causer and give reasons.

## 4. The system operator has calculated the MW lost during the event based on its investigation

- 4.1. Clauses 8.64 and 8.65 of the Code set out how to calculate the event charge payable by the causer of an under-frequency event. This in turn enables calculation of the rebates paid for under-frequency event.

- 4.2. Central to the event charge calculation is determining the MW of injection lost at one or more grid injection points because of the under-frequency event. The system operator determines the MW lost as part of its investigation into an under-frequency event.
- 4.3. The system operator has determined the loss of injection into the grid for the 26 July 2024 event was 231MW at the grid connection point for Clyde generation station, resulting in an event charge of \$213,750.00.
- 4.4. The system operator's calculation of the MW lost for this event is included in the report (Appendix B). The system operator's calculation does not form part of the Authority's draft determination. However, the Authority acknowledges that the calculation is central to determining the under-frequency event charge payable by the causer, and therefore also to the rebate (calculated by the clearing manager) paid for an under-frequency event. The Authority invites comment on the system operator's calculation of the MW lost.
- 4.5. Any comments received will be passed to the system operator.

Q2. Do you agree with the system operator's assessment that 231MW was lost from the power system in the 26 July 2024 under-frequency event? If not, please advise your view on the MW lost and give reasons.



## Appendix A Format for submissions

Submitter	
Questions	Comments
Q1. Do you agree with the draft determination that Transpower as grid owner is the causer of the under-frequency event at 7:21am 26 July 2024? If not, please advise your view on the causer and give reasons.	
Q.2 Do you agree with the system operator's assessment that 231MW was lost from the power system in the 26 July 2024 under-frequency event? If not, please advise your view on the MW lost and give reasons.	

## **Appendix B System operator causation report 26 July 2024 under-frequency event**

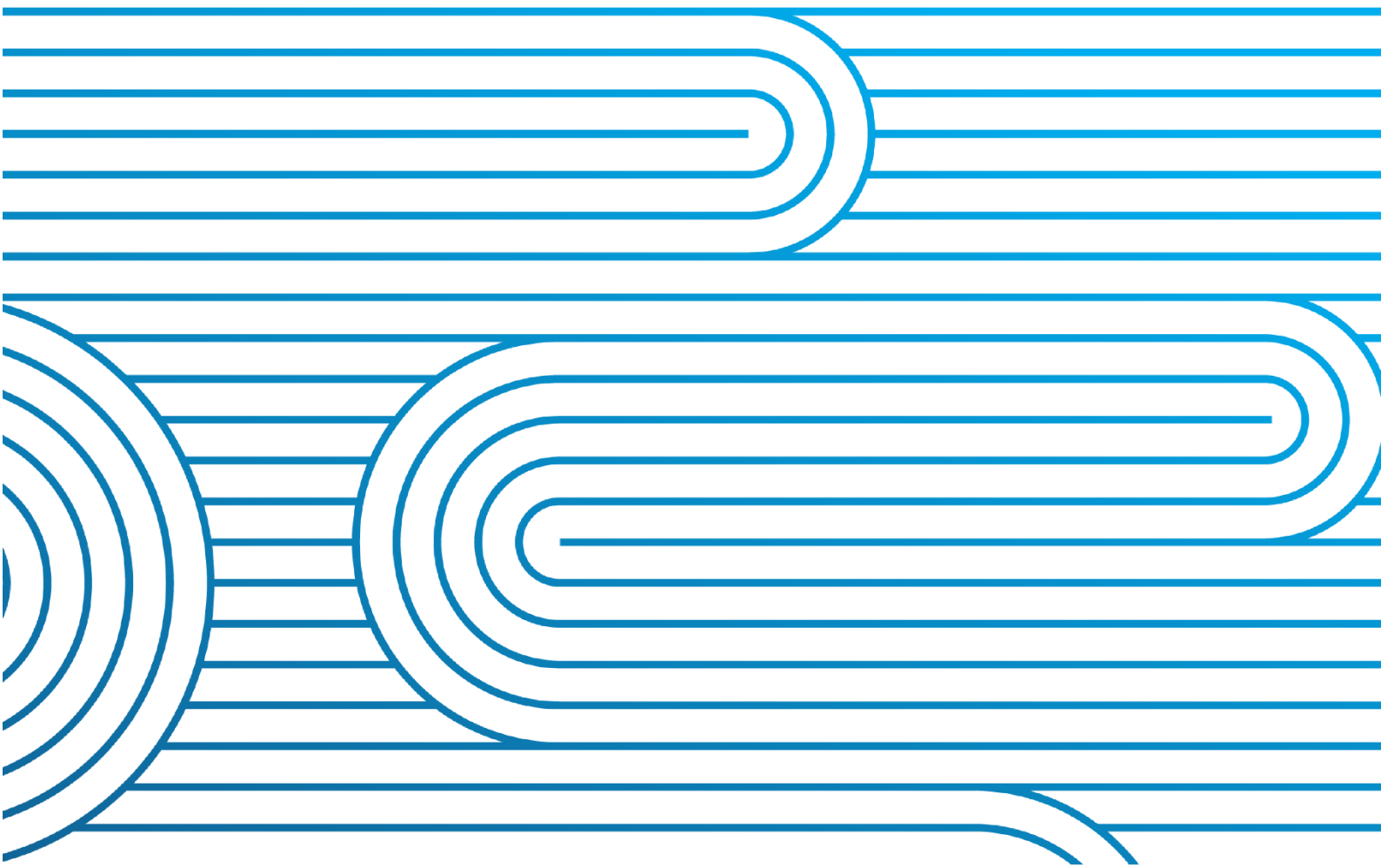
# Causation Report

## 26 July 2024

### Under-Frequency Event

System Operator Event 4477

December 2024



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## IMPORTANT

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### Disclaimer

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Purpose ..... 4

Executive summary ..... 4

System events – 26<sup>th</sup> July 2024 ..... 5

    Prior to the under-frequency event ..... 5

    The under-frequency event ..... 5

    After the under-frequency event ..... 7

    Corrective Actions ..... 7

    Further recommendations ..... 7

Rational for recommendation ..... 8

    Factors considered ..... 8

Calculation of MW Lost ..... 9

Appendix 1: Correspondence ..... 10

    1.1 Confirmation of event notice ..... 10

    1.2 system operator request for information – Contact energy Limited ..... 11

    1.3 System Operator request for information – Grid Owner ..... 12

    1.4 Contact response ..... 13

    1.5 Grid Owner response ..... 15

Appendix 2: Event investigation ..... 19

Appendix 3: Charts ..... 32

    System Frequency (South Island) and MW Trace 26<sup>th</sup> July 2024 ..... 32

## PURPOSE

On 26<sup>th</sup> July 2024 a reduction of energy into the power system caused the system frequency in the South Island to fall below 49.25 Hz, resulting in an under-frequency event.

Pursuant to clause 8.60 of the Electricity Industry Participation Code (**Code**), the System Operator investigated the event to assist the Electricity Authority (**Authority**) in determining a causer of the under-frequency event.

This Causation Report is provided to the Authority pursuant to clause 8.60(5) of the Code and includes the following:

4

- The System Operator's recommendation of the causer of the under-frequency event.
- The System Operator's reasons for forming its view.
- The information considered in reaching this view.

## EXECUTIVE SUMMARY

At 07:21:55 on 26<sup>th</sup> July 2024 Contact Energy's Clyde Units 2 and 3 tripped.

The disconnection of generation from Clyde Unit 2 and Unit 3 removed 231.000MW of injection into the power system.

At 07:21:56 the South Island frequency fell to 49.14 Hz. Either of the North or South Island frequencies falling below 49.25 Hz constitutes an under-frequency event, as defined in the Code.

Neither Contact Energy or Transpower (Grid Owner) believes that they are the causer of the event.

Investigation into the tripping and other system events found that planned operation of a Grid Owner disconnector at Clyde generating station caused a direct current (DC) earth fault on the secondary system. The lengthy signal cabling at Clyde introduced an erroneous protection signal that led to the triggering of the primary protection system and tripping of Clyde generating units (G2 and G3), resulting in an under-frequency event in the South Island.

The Grid Owner confirmed that the earth fault was caused by a flaw in the build quality of the flexible wiring connection of the disconnector motor owned by the Grid Owner.

There are currently no mandatory standards which should have been adhered to by Contact Energy that would have prevented the tripping of the Clyde units.

Accordingly, the System Operator recommends that the Grid Owner be found as the causer of the under-frequency event on 26<sup>th</sup> July 2024.

## SYSTEM EVENTS – 26<sup>TH</sup> JULY 2024

### Prior to the under-frequency event

According to the Grid Owner, there were no protection operations of any grid assets in the vicinity of Clyde on 26th April 2024 that may have contributed to the frequency falling below 49.25 Hz.

### The under-frequency event

At 07:21:55 the disconnections of Clyde Unit 2 and Clyde Unit 3 removed 231.000MW of generation injection into the power system. Consequently, this reduced the system frequency in the South Island to 49.14 Hz at 07:21:56.

During planned operation of Clyde disconnecter 473, a 125V DC earth fault developed on the secondary wiring of the disconnecter motor supply. The cause of the motor DC fault was determined to be an exposed flexible DC supply connection to motor brush that was in contact with the manual crank pole.

According to both the Grid Owner and Contact Energy, the disconnection equipment initiated the earth fault due to faulty connection.

Clyde has a shared secondary DC system which is used to supply DC to the Grid Owner protection system as well as Clyde station equipment. Grid Owner owns the Clyde generator disconnectors and Contact Energy have operational control of this asset.

The earth fault changed the DC system reference voltages, causing a spike in positive voltage reference and a dip in negative voltage reference. The change in the negative rail voltage from the disconnecter caused by the earth fault caused capacitive current discharge on the “TRANSPower BZ/CBFail TRIP” signal cable, activating Contact Energy’s SEL 2440 primary protection relay which tripped both Clyde generating units (G2 and G3) and the loss of 231.000 MW of generation injection caused the under-frequency event in the South Island.

Clyde has lengthy (200 – 300m) trip signal cables which control the remote initiating relays. These are susceptible to capacitance build up.

The Grid Owner disconnectors are supplied from Contact Energy’s DC panel with separate circuit breakers which provides protection for the faults in the DC supply connections.

The Grid Owner’s relays did not pick up the erroneous signal as the Grid Owner had applied protection settings which increase immunity to erroneous signals from Contact Energy’s remote initiating relays. These include high burden relays, pull-down resistors, and debounce settings of 5 milliseconds (0.25 cycles).

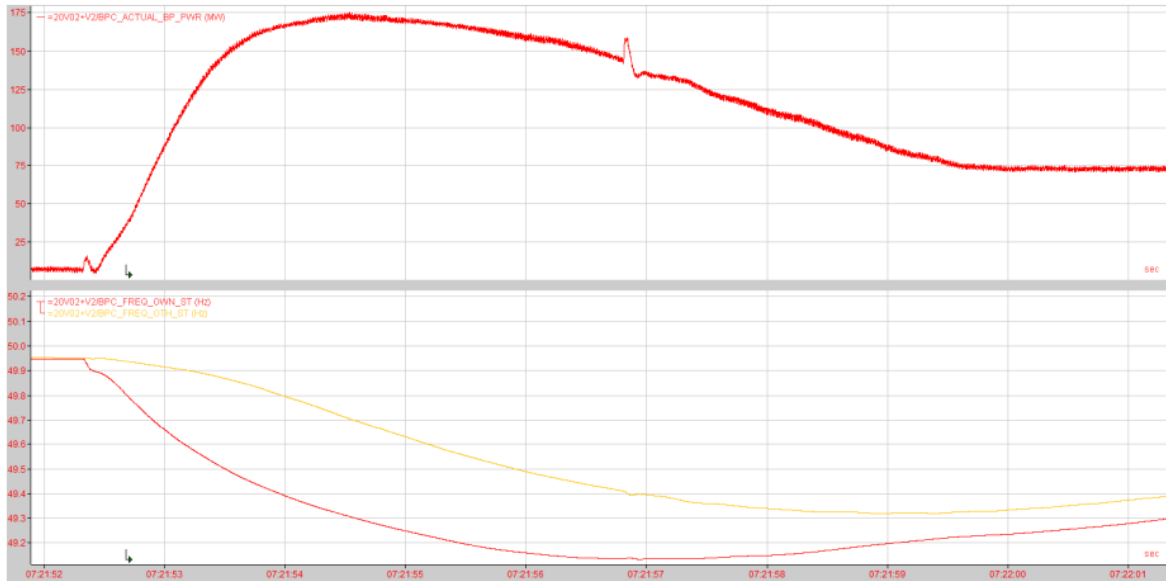
No other protection relays owned by Contact Energy picked up this erroneous input signal. Contact Energy confirmed that they did not have pull down resistors or high burden relays on these inputs and there were 0 millisecond debounce settings applied.

There were no HVDC events that contributed to this event. On the contrary, the HVDC system responded to lessen the severity of the UFE by increasing the bipole south power transfer from 6 MW to 171 MW. The response was within the defined 250 MW maximum frequency keeping

control response that the HVDC link is set to provide. The HVDC recorded the frequency bottom out at 49.134 Hz at Benmore and 49.319 Hz at Haywards.

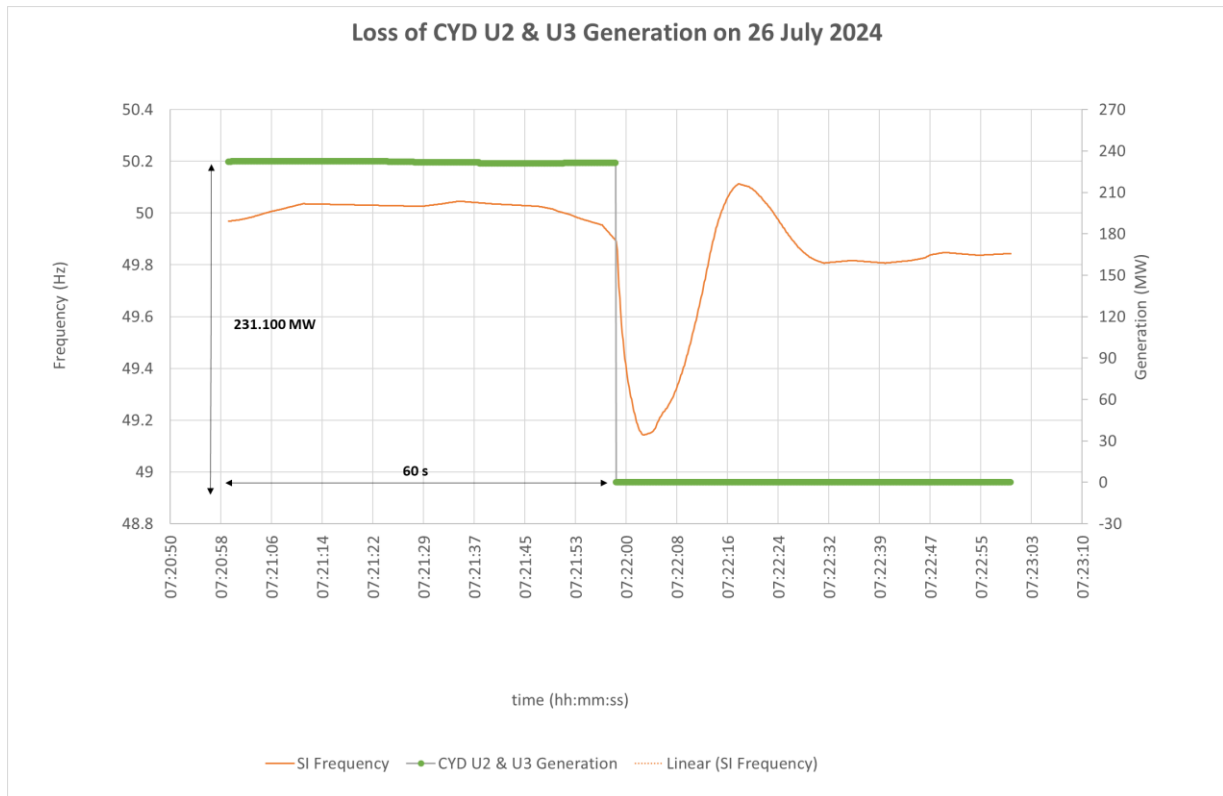
Below graph shows the response of the HVDC during the event.

6



Please note the system operator’s graph below does not precisely time the tripping of Clyde Units. This is because there is a time delay in the system operator’s SCADA data (which resulted in the delayed recording of Clyde Unit 2 and Clyde Unit 3 tripping).

**South Island Frequency**





## After the under-frequency event

At the time of the event, the System Operator had dispatched:

- South Island (generation) instantaneous reserve providers to be available to provide 111.70 MW FIR and 122.10 MW SIR.
- South Island interruptible load providers to be available to trip 1.40 MW SIR.

These reserve providers responded, returning the frequency to the normal band (49.8 Hz – 50.2 Hz) within twelve seconds.

Performance of instantaneous reserve providers in an under-frequency event is assessed by the System Operator to ascertain if these providers are meeting their respective ancillary service contracts. Assessment confirmed that all ancillary service contract obligations were met satisfactorily. One interruptible load provider was scheduled for dispatch and responded in full.

No other event or asset operation was identified as occurring at or around the time of the under-frequency event.

## Corrective Actions

The Grid Owner identified that the exposed flexible connection wiring could be a shortcoming of manufacturer design. To mitigate against future DC earth faults, the Grid Owner has covered the crank pole in the disconnection equipment with heat insulating material to avoid the flexible connection contacting the crank pole and requesting service providers to do the same modification to all disconnection / earth switches.

After consultation with the manufacturer and other industry experts, Contact Energy have updated their protection setting to include a debounce value of 5 milliseconds (0.25 cycles) aligning with the Grid Owner debounce value. The new configuration has been tested with no observed maloperation.

## Further recommendations

The Grid Owner to ensure that all cable connections within the secondary systems are well maintained to eliminate possible earth faults in all sites.

The Grid Owner to alert asset owners of the need for enhanced protection design and standards for wider industry adoption because of the potential for secondary faults or disturbances to trip protection relays as a consequence of signal cable design, routing and location.

Contact Energy to investigate whether any stations use a similar protection setup to receive signals from a remote initiating relay.

Contact Energy should also consider using pull down resistors to increase protection system immunity.

## RATIONAL FOR RECOMMENDATION

### Factors considered

Only one event occurred in close proximity to the South Island frequency falling below 49.25 Hz, namely the tripping of Clyde Unit 2 and Clyde Unit 3 at 07:21:55 on 26<sup>th</sup> July 2024.

Accordingly, assessment of this information confirms that the tripping of Clyde Unit 2 and Clyde Unit 3 can be linked with the South Island frequency falling below 49.25Hz.

Contact Energy and the Grid Owner were both asked if they considered themselves the causer of the under-frequency event.

Both the Grid Owner and Contact Energy do not believe they caused the under-frequency event.

The planned operation of the Clyde disconnecter caused the DC supply to the disconnecter motor to experience an earth fault.

The Grid Owner confirmed that the earth fault was due to a flaw in the build quality of the flexible wiring connection of the disconnecter motor owned by the Grid Owner.

The earth fault changed the DC system reference voltages, causing capacitive current discharge on the signal cable which activated the protection relay erroneously causing the Clyde units to trip.

The lengthy trip signal cables at Clyde which control the remote initiating relays are susceptible to capacitance build up.

Contact Energy did not have enhanced protection set up to reduce the impacts of an earth fault which caused a discharge of capacitive current into the protection input, activating the primary system protection.

The Grid Owner is of the opinion that a secondary DC earth fault should not operate the primary system protection and confirmed that no protection was triggered at the Grid Owner side due to this earth fault.

If Contact Energy had implemented protection system settings in a similar way to Grid Owner protection settings, the secondary DC earth fault would not have activated primary system protection which caused the tripping of the Clyde generation units.

There are currently no mandatory standards for appropriate protection setup to reduce the impacts of an earth fault, therefore, Contact Energy were not required to have the protection settings that would have avoided the tripping of the Clyde units.

In accordance with the definition of “causer” in Part 1 (a)(i) of the Electricity Industry Participation Code 2010, if an interruption or reduction of electricity from a single generator’s asset is caused by the Grid Owner’s property, the ‘causer’ in relation to that under-frequency event is the Grid Owner.

## CALCULATION OF MW LOST

The purpose of this calculation is to determine the MW value provided to the clearing manager for the purposes of calculating the under-frequency event charge.

The System Operator follows the procedure 'Calculating the Amount of MW lost' (PR-RR-017) to determine the MW lost. This procedure follows the formula set out in clause 8.64 of the Code for calculating an event charge.

The event charge payable by the causer of an under-frequency event (referred to as "Event e" below) must be calculated in accordance with the following formula:

$$EC = ECR \times \left( \sum_y INT_{y,e} - INJ_D \right)$$

where

$EC$  is the event charge payable by the causer

$ECR$  is \$1,250 per MW

$INJ_D$  is 60 MW

$INT_{y,e}$  is the electric power (expressed in MW) lost at point y by reason of Event e (being the net reduction in the injection of electricity (expressed in MW) experienced at point Y by reason of Event e) excluding any loss at point y by reason of secondary Event e

y is a point of connection or the HVDC injection point at which the injection of electricity was interrupted or reduced by reason Event e

As the  $ECR$  and  $INJ_D$  values are constants the values to calculate and complete the formula are y and  $INT_{y,e}$ .

Using the event charge formula the calculation is as follows:

$$\text{Event Charge} = \$1250/\text{MW} * (231.000\text{MW} - 60\text{MW})$$

$$\text{Event Charge} = \$213,750.000$$

# Appendix 1: CORRESPONDENCE

## 1.1 CONFIRMATION OF EVENT NOTICE

10



### Customer Advice Notice

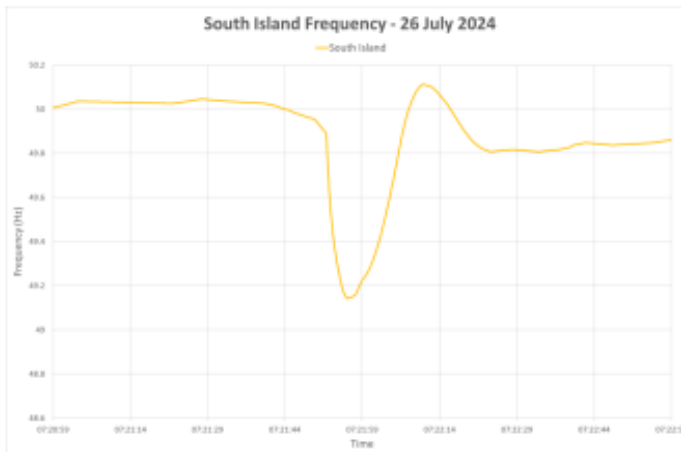
To: CAN NZ Participants      From: The System Operator  
 Sent: 30-Jul-2024 13:04      Telephone: 0800 488 500  
 Ref: 5534283075      Email: NMData@transpower.co.nz

Revision of:

Under-Frequency Event Confirmation

The system operator wishes to advise market participants of an under-frequency event which occurred in the South Island on 26 July 2024.

Event ID:	4477
Affected Islands:	South Island
South Island Minimum Frequency:	49.14 Hz
Time (start of UFE):	07:21:55
Time (of min. frequency):	07:21:56



The System Operator is investigating the cause of the following under-frequency event in accordance with Part 8, clause 8.60 (1) of the Electricity Industry Participation Code 2010. Ancillary Services Agents who were dispatched to provide instantaneous reserves at the time of the event should be prepared to provide information to the System Operator within 5 Business Days of receiving a request for information in accordance with clause 8.60(4) of the Electricity Industry Participation Code 2010.

Market Operations

Transpower NZ Ltd

A revision of this notice will be issued if there is any change to the situation above.

Transpower New Zealand Ltd The National Grid

P.O. Box 1021,  
 Wellington 6140,  
 New Zealand  
 Telephone: 04 590 7470  
 market.operations@transpower.co.nz

## 1.2 SYSTEM OPERATOR REQUEST FOR INFORMATION – CONTACT ENERGY LIMITED



**TRANSPower**

Waikoukou  
22 Boulcott Street  
PO Box 1021, Wellington  
New Zealand  
Telephone +64-4-590 7000  
Facsimile: +64-4-495 7100

5 August 2024

Gerard Demler  
Contact Energy Limited  
Level 2, Harbour City Tower  
29 Brandon Street  
Wellington 6011

Dear Gerard,

### 26<sup>th</sup> July 2024 Under-Frequency Event

At 07:21 on 26<sup>th</sup> July 2024 an under-frequency event occurred in the South Island. We are investigating the event and require the following information from you:

- Could you provide information regarding the event and what you believe may have caused the under-frequency to occur on 26<sup>th</sup> July 2024.
- We have assessed the MW lost during the event as 115.600 MW at CYD G2 and 115.500 MW at CYD G3. Can you please confirm this assessment or provide data that indicates a different value of MW lost. We rely on SCADA data, but your data from site may be more accurate.
- Could you also confirm whether or not you could have been the causer of the under-frequency event as per the Code.

The information you provide will be used by the system operator to recommend to the Electricity Authority who the causer of the event was. The Electricity Authority will make the final determination of causer.

Please contact me if you require any further information.

Yours sincerely,

**SAMANTHA NAIDOO**

Corporate Counsel – Compliance & Impartiality

## 1.3 SYSTEM OPERATOR REQUEST FOR INFORMATION – GRID OWNER

**TRANSPower**

Waikoukou  
22 Boulcott Street  
PO Box 1021, Wellington  
New Zealand  
Telephone +64-4-590 7000  
Facsimile: +64-4-495 7100

**12**

5 August 2024

Mao Reyes  
Grid Compliance Manager  
Grid Owner  
Transpower  
Wellington

Dear Mao,

### 26<sup>th</sup> July 2024 Under-Frequency Event

At 07:21 on 26<sup>th</sup> July 2024 an under-frequency event occurred in the South Island. We are investigating the event and require the following information from you:

- Could you provide information regarding the event and what you believe may have caused the under-frequency to occur on 26<sup>th</sup> July 2024.
- Could you also confirm whether or not you could have been the causer of the under-frequency event as per the Code.

The information you provide will be used by the system operator to recommend to the Electricity Authority who the causer of the event was. The Electricity Authority will make the final determination of causer.

Please contact me if you require any further information.

Yours sincerely,

A handwritten signature in blue ink, appearing to read 'S. Naidoo', enclosed within a blue oval shape.

**SAMANTHA NAIDOO**

Corporate Counsel – Compliance & Impartiality

## 1.4 CONTACT RESPONSE



9 August 2024

Samantha Naidoo  
Corporate Counsel – Compliance & Impartiality  
Transpower New Zealand Ltd  
22 Boulcott Street  
Wellington 6011

13

Dear Samantha,

**Subject: 26 July Under-Frequency Event**

Thank you for your letter of enquiry dated 5 August 2024. I have sought information from site on this matter and their response is outlined below:

Key points in summarising activity associated with the Clyde U2 and U3 Tripping on Friday 26 July at 07:21.

The Clyde Generation Units 2 and 3 tripped simultaneously during a planned switching (opening) of the Generation Unit 4 Transpower Disconnecter (DIS473). Following the tripping event immediate action was taken to confirm that the generating units were safely shutdown due to the risk of transient machine overspeed. The Generation Technician responding at the time noted multiple protection relay flags operated prompting an engineering investigation and advice notice which is a procedural requirement when any SCE protection device operates.

The engineering investigation concluded that the initiating event (caused by a protection operation) was a system disturbance on the common 110V DC system at Clyde. The disturbance occurred simultaneously with the operation of DIS473. The DC system voltage was analysed and the resultant voltage signature symptomatic of an earth fault during the switching of DIS473.

A Contact engineering advice notice was subsequently issued internally on Friday 26 July to advise of the risk of trip during the switching of any 220kV unit disconnectors at Clyde. This advice notice was accepted, with an Equipment Limitation Notice (ELN) issued to restrict Clyde Generation to 0MW during any unit disconnector operation or transfer of operational control. Clyde U2 and U3 were subsequently declared unavailable.

Contact Energy Limited Level 2 Harbour City Tower, 29 Brandon Street, Wellington 6011 | PO Box 10742,  
Wellington 6143  
P: +64 4 499 4001 | F: +64 4 499 4003 | W: contactenergy.co.nz

Subsequent testing on Saturday 27 July with Clyde at OMW (spilling) confirmed a repeatable earth fault associated to DIS473. This was accompanied by a 110V DC system disturbance & protection relay "assertions" (input sequence of events) during the switching.

As an interim risk reduction measure Contact Engineering completed a temporary protection relay sensitivity change to mitigate the risk posed by the switching of DIS473, or any other faulty 220kV disconnector. This setting change was validated during further planned testing on Sunday 4 August which necessitated a further station shutdown at Clyde (with further spill required). All eight disconnectors were open and closed during this planned testing. This validated that the protection setting change successfully managed any relay assertions during switching of all Clyde unit 220kV disconnectors. The ELN restricting Clyde station to OMW output for all 220kV disconnector switching was subsequently cancelled.

Transpower was notified of the suspected fault on DIS473, with Omexom attending site on Tuesday 6 August to investigate the fault and commence planning to rectify the defect on DIS473. Transpower have since confirmed on 9 August that Clyde DIS473 had a 125V DC secondary earth fault on 26/07/2024 at 07:21AM.

Contact believes the root cause of this event to be a defective disconnector (DIS473) which is owned and operated by Transpower. Therefore, we believe Contact is not the causer of this under-frequency event as per the Code.

If you require further information on this matter, please get in touch with me in the first instance. Our engineering team based at Clyde are available to discuss any details of their response above.

Yours sincerely,



**Gerard Demler**  
Transmission Manager, Contact Energy



## 1.5 GRID OWNER RESPONSE



Waikoukou  
22 Boulcott Street  
PO Box 1021  
Wellington 6140  
New Zealand  
P 64 4 590 7000  
F 64 4 590 6968  
[www.transpower.co.nz](http://www.transpower.co.nz)

09 August 2024

Samantha Naidoo  
Corporate Counsel - Compliance & Impartiality Manager  
System Operations  
Transpower  
Wellington

Dear Samantha

### 26<sup>th</sup> July 2024 South Island Under-Frequency Event

I am writing in response to your letter dated 5<sup>th</sup> August 2024, concerning the under-frequency event (UFE) that transpired on the 26<sup>th</sup> of July 2024 in the South Island.

Our understanding of the event is as follows:

- Between 07:21:53 to 07:21:55 on the 26<sup>th</sup> of July, operation of the CYD disconnecter 473, a 125V DC earth fault developed on the secondary wiring of the disconnecter motor supply. Transpower owns this disconnecter and Contact have operational control of this asset.
- At 07:21:55 on the 26<sup>th</sup> of July, units G2 and G3 at Clyde tripped, resulting in an under-frequency event occurring in the South Island. It appears Contact's generator protection tripped G2 and G3 at the same time the 125V DC wiring fault occurred.
- Market participants were promptly informed of this occurrence through a frequency excursion notice (please refer to Attachment A). This notice, issued at 07:41 on 26<sup>th</sup> July, stated that Clyde generation had tripped, causing the frequency in the North and South Islands to drop to 49.33Hz and 49.14Hz, respectively.
- A customer advice notice (please refer to Attachment B), issued at 13:04 on 30<sup>th</sup> July, confirmed the occurrence of an under-frequency event in the South Island at 07:21:55 on 26<sup>th</sup> July 2024.
- It is important to note that there were no protection operations of any grid assets in the vicinity of Clyde on 26<sup>th</sup> July 2024.
- Furthermore, there were no HVDC events that contributed to this event. In fact, the HVDC system responded in a manner that mitigated the severity of the UFE by increasing the bipole south power transfer from 6MW to 171MW. The HVDC has recorded the frequency bottom out at 49.134Hz at Benmore and 49.319Hz at Haywards. Its response is within the defined 250MW maximum frequency keeping control response that the HVDC link is set to provide. We believe that the response of the HVDC has avoided the frequency at Benmore from dropping further.

Below graph shows the response of the HVDC during the event.

Transpower New Zealand Ltd The National Grid



**TRANSPower**  
 Keeping the energy flowing

Waikoukou  
 22 Boulcott Street  
 PO Box 1021  
 Wellington 6140  
 New Zealand  
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 F 64 4 590 6968  
[www.transpower.co.nz](http://www.transpower.co.nz)

16



Considering the above information, I do not believe that the Grid Owner was the causer of the under-frequency event that occurred on this day.

I trust this clarifies our understanding of the event. Please do not hesitate to contact us should you require further information.

Yours sincerely

**Mao Reyes**  
 Grid Compliance Manager

Transpower New Zealand Ltd The National Grid

Attachment A



## Excursion Notice

**To:** Excursion NZ Participants  
**Sent:** 26-jul-2024 07:41  
**Ref:** 5526023317

**From:** The System Operator  
**Telephone:** 0800 488 500  
**Email:** NMData@transpower.co.nz

**Revision of:**

<b>Excursion:</b>	Frequency		
<b>Time:</b>	26-jul-2024 07:21		
<b>Location:</b>	National		
<b>Affected Plant:</b>	Clyde Generation Tripped		
<b>SI Hz Level:</b>	49.14	<b>NI Hz Level:</b>	49.33
<b>Comments:</b>	Clyde Generation Tripped.		

Frequency Excursion notices are only issued if the deviation is out side 49.5 and 50.5 Hz.

A revision of this notice will be issued if there is any change to the situation above.

Transpower New Zealand Ltd The National Grid

Attachment B



## Customer Advice Notice

**To:** CAN NZ Participants  
**Sent:** 30-Jul-2024 13:04  
**Ref:** 5534283075

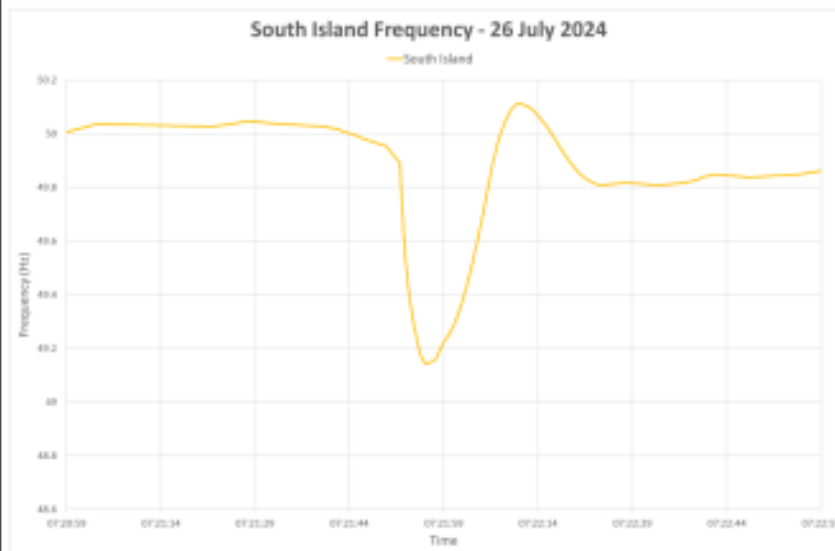
**From:** The System Operator  
**Telephone:** 0800 488 500  
**Email:** NMData@transpower.co.nz

Revision of:

**Under-Frequency Event Confirmation**

The system operator wishes to advise market participants of an under-frequency event which occurred in the South Island on 26 July 2024.

<b>Event ID:</b>	4477
<b>Affected Islands:</b>	South Island
<b>South Island Minimum Frequency:</b>	49.14 Hz
<b>Time (start of UFE):</b>	07:21:55
<b>Time (of min. frequency):</b>	07:21:56



The System Operator is investigating the cause of the following under-frequency event in accordance with Part 8, clause 8.60 (1) of the Electricity Industry Participation Code 2010. Ancillary Services Agents who were dispatched to provide instantaneous reserves at the time of the event should be prepared to provide information to the System Operator within 5 Business Days of receiving a request for information in accordance with clause 8.60(4) of the Electricity Industry Participation Code 2010.

**Market Operations**

Transpower NZ Ltd

A revision of this notice will be issued if there is any change to the situation above.



P.O. Box 1021,  
 Wellington 6140,  
 New Zealand  
 Telephone: 04 590 7470  
 market.operations@transpower.co.nz

## Appendix 2: EVENT INVESTIGATION

### Event investigation – Under-frequency Event 26th July 2024



<b>Date:</b>	2 December 2024	<b>SO Event No:</b>	4477
<b>To:</b>	Market & Business	<b>Event Status:</b>	<input type="checkbox"/> AO Breach
<b>From:</b>	Kanishka Fonseka		<input type="checkbox"/> SO Breach
<b>Subject:</b>	Under frequency Event (26/07/2024)		

19

#### 1. Incident Caused Analysis Method (ICAM) assessment

Based on data gathered from the incident, the **root cause** was the Grid Owner equipment initiating the earth fault, due to the faulty exposed flexible connection contacting the earthed DIS473 crank pole at Clyde power station. If the Grid Owner had identified the flaw in the flexible wiring connection during routine maintenance or installation and had it rectified, the earth fault (or **initial event**) would not have occurred.

A **latent condition existed** (where the exposed flexible wiring connection at DIS473 was an unknown pre-existing design flaw). This **combined adversely with a local triggering condition**, (the bare flexible connection made contact with the crank pole of DIS473); **alongside an active failure**, (where the lengthy signal cabling at Clyde power station, and the lack of any debounce/snubber protection, combined to introduce an “erroneous” protection signal that led to the triggering of the “low immunity” primary protection system and tripping of Clyde generating units (G2 and G3, approximately 230 MW), resulting in an under-frequency event (UFE) in the South Island.

#### 2. Summary

- 2.1. On 26 July 2024, a planned operation of a disconnecter at Clyde generating station (CYD) caused a direct current (DC) earth fault on the secondary system. The lengthy signal cabling at CYD introduced an “erroneous” protection signal that led to the triggering of the “low immunity” primary protection system and tripping of CYD generating units (G2 and G3, approximately, 230 MW), resulting in an under-frequency event (UFE) in the South Island.

#### 3. Background

- 3.1. On 26 July 2024 at 07:21:55 grid experienced a UFE where the South Island frequency fell to 49.14 Hz (at 07:26:56).
- 3.2. The planned operation of the CYD disconnecter 473 (DIS473) caused a 125 V DC earth fault on the secondary wiring of the disconnecter motor supply.
- 3.3. The earth fault caused a protection relay’s DC voltage reference value to change. This tripped the CYD generating units (G2 and G3) on Bus Zone (BZ) protection.

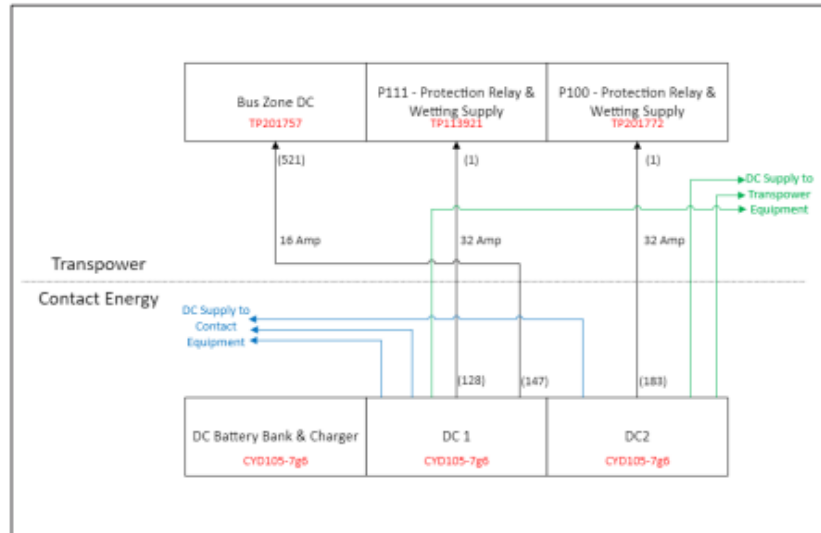
1



4. Event Details

4.1. CYD has a shared secondary DC system which is used to supply DC to the Transpower (Grid Owner) protection system as well as CYD station equipment. Figure 1.

Figure 1- CYD generating station DC System diagram



4.2. CYD generator disconnectors (DIS413, 415, 433, 435, 453, 455, 473 & 475) are owned by the Grid Owner and operated by Contact Energy. See the Figure 1 for information.

4.3. The planned operation of CYD DIS473 caused the DC supply to the disconnector motor to experience an earth fault.

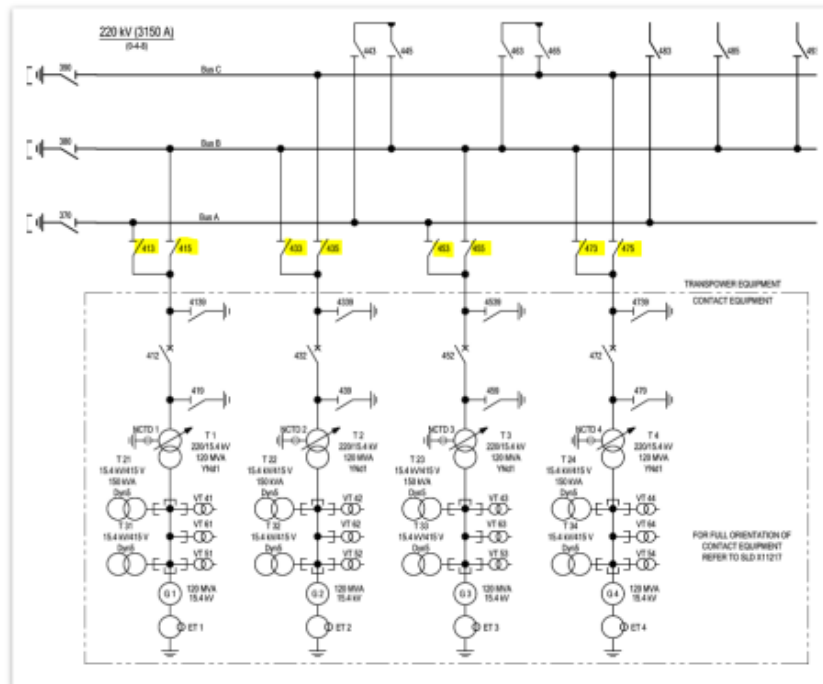
4.4. The cause of the motor DC fault was determined to be an exposed flexible DC supply connection to motor brush that was in contact with the manual crank pole.

4.5. CYD has lengthy (200 – 300 m) trip signal cables which control the remote initiating relays. These are susceptible to capacitance build up.

4.6. Contact Energy and the Grid Owner send protection signals through these trip signal cables to provide protection inputs and coordinate protection systems for each other.

4.7. Contact Energy’s CYD generating units (G2 and 3), which were online during this event, tripped due to a “TRANSPower BZ/CBFail TRIP”.

Figure 2- CYD generating station single line diagram



**5. Analysis**

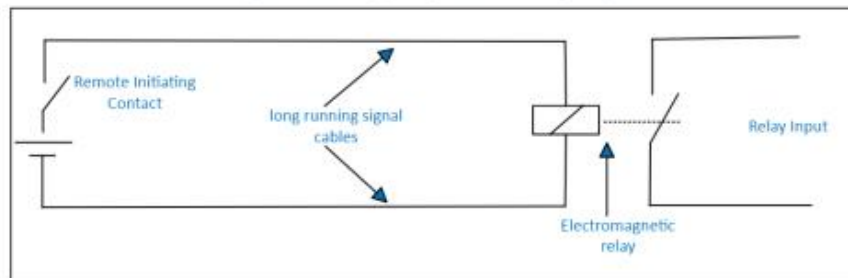
- 5.1. When CYD DIS473 was operated during a planned operation, an earth fault occurred. The earth fault was caused by a wire (uninsulated flexible connection to motor brush terminal) that contacted a manual crank pole and shorted to the ground.
- 5.2. The earth fault changed the DC system reference voltages. It created a spike in the positive voltage reference (green curve) and a dip in negative voltage reference (light blue) as shown in the Figure 3.

Figure 3 - CYD generating station DC traces during the earth fault



5.3. Contact Energy’s SEL 2440 relay inputs are connected to the Grid Owner’s initiating relay via a set of lengthy signal cable (200-300 m) owned by the Grid Owner. The earth fault caused a discharge of capacitive current into Contact Energy’s SEL 2440 relay and caused primary protection to trip CYD generating units (G2 and G3). See Figure 4 below.

Figure 4 - Basic Diagram of Remote Initiating Relay



- 5.4. No other protection relays from either Contact Energy or the Grid Owner picked up this erroneous input signal.
- 5.5. The Grid Owner’s relays also receive signals from the remote initiating relays from Contact Energy. The Grid Owner’s relays did not pick up this erroneous signal as the Grid Owner use the following measures to increase immunity to erroneous signals of this nature:





- High burden relays.
  - Pull down resistors.
  - Debounce settings of 5 ms (Contact Energy used debounce settings of 0 ms).
- 5.6. The Grid Owner disconnectors are supplied from the Contact Energy DC panel with separate circuit breakers which provides protection for the faults in the DC supply connections.
- 5.7. Information provided by the Grid Owner:
- The Grid Owner confirmed that the earth fault was due to a flaw in the build quality of the disconnector motor owned by the Grid Owner.
  - The Grid Owner believed that a secondary DC earth fault should not operate the primary system protection and confirmed that no protection was triggered at the Grid Owner side due to this earth fault.
- 5.8. Information provided by Contact Energy:
- Contact Energy agreed that a change in the negative rail voltage from the disconnector earth fault caused capacitive current discharge on the "TRANSPower BZ/CBFail TRIP" signal cable. This activated the protection relay and resulted in the tripping of CYD generating units (G2 and G3).
  - Contact Energy confirmed that they did not have pull down resistors on these inputs and there were no debounce settings applied.
  - Contact Energy investigated the events and through consultation with the manufacturer and other industry experts, they changed the debounce value to 5 ms (0.25 cycles). Contact did not observe maloperation through testing.

## 6. Causes and Corrective Actions

### *Cause of event*

- 6.1. The Grid Owner equipment initiated the earth fault due to faulty connection. If the Grid Owner had identified the flaw in flexible wiring connection during routine maintenance or installation and had it rectified, the earth fault would not have occurred.
- 6.2. Contact Energy did not have an appropriate protection setup to reduce the impacts of an earth fault which caused a discharge of capacitive current into the protection input. If Contact Energy had implemented protection system settings and setup similar to the Grid Owner, the secondary DC earth fault would not have activated primary system protection tripping CYD generation units (G2 and G3)



### *Corrective Actions*

- 6.3. The Grid Owner investigated into the cause and identified that the exposed flexible connection wiring could be a shortcoming of manufacturer design, as a mitigation for future DC earth fault of the same cause, the Grid Owner has covered the crank pole with heat insulating material to avoid the flexible connection making contact with the crank pole and requesting service providers to do the same modification to all disconnection / earth switches.
- 6.4. Contact Energy have changed the debounce value to 5 ms (The same value used by the Grid Owner). They have tested the new configuration and confirmed that they did not observe any maloperation.

### **7. Recommendations**

- 7.1. The Grid Owner to ensure cable connections within the secondary systems are maintained to prevent the occurrence of similar earth faults at all sites.
- 7.2. The Grid Owner implemented a “higher” protection design standard at CYD as a precautionary measure to increase their protection system’s resilience and robustness. During this event, the Grid Owner’s protection system had “immunity” against “erroneous” protection input, whereas Contact Energy’s protection system did not. The Grid Owner to ensure all Grid Owner sites have similar protection design standard.
- 7.3. The Grid Owner to alert asset owners the impact of signal cable design, routing and location on protection relay trip due to unrelated secondary DC earth fault or electrical disturbance and communicate the need for “higher” protection design standard for wider industry adoption.
- 7.4. Contact Energy to investigate, identify and implement the enhanced protection settings used for CYD at other power stations, such as the use of pull-down resistors and changing the debounce value to increase protection system’ “immunity” against “erroneous” protection input.

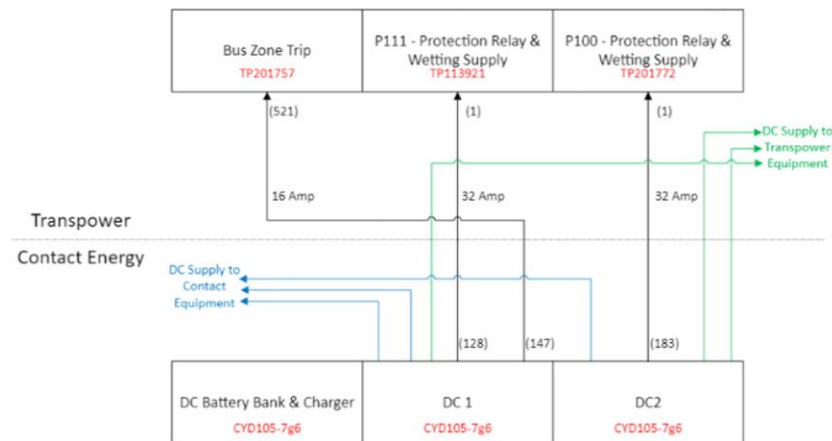
## APPENDIX A – EMAIL PROVIDED BY CONTACT ENERGY AND TRANSPOWER (GRID OWNER)

**From:** Kanishka Fonseka <Kanishka.Fonseka@transpower.co.nz>  
**Sent:** Wednesday, 2 October 2024 1:04 pm  
**To:** Gerard Demler <Gerard.Demler@contactenergy.co.nz>  
**From:** Justine Park <Justine.Park@transpower.co.nz>  
**Subject:** CYD Tripping on 26th July 2024

Hi Gerard,

As I informed to you over the phone while ago, I'm working on this event and would like get further information around this and appreciate if you can provide me some clarification for the below queries. Please refer to the below DC distribution sketch to find drawing numbers and equipment I'm referring to.

- Contact DC1 & DC2 provide DC supply to the all station and Bus Zone equipment (all secondary supply to Transpower equipment at CYD and Transpower protection – Bus Zone trip + P111 +P100). Transpower provides BZ cross trip input back to Contact.
  - Does the supply cables from DC1 & DC2 to Transpower equipment separated from the BZ cross trip input cables?
  - If yes, how you think this protection relay assertions happened?
- Is DC supply for the DIS473 provided through DC1 & DC2 panel by Contact or other connection point at BZ?
- If possible please confirm the ownership/responsibility of below items (Contact or Transpower)
  - DC supply cables between DC1 & DC2 panels and Transpower equipment & relay supply panels
  - BZ cross trip input signal cables



**From:** Gerard Demler <Gerard.Demler@contactenergy.co.nz>  
**Sent on:** Tuesday, October 8, 2024 1:26:14 AM  
**To:** Kanishka Fonseka <Kanishka.Fonseka@transpower.co.nz>  
**CC:** Justine Park <Justine.Park@transpower.co.nz>  
**Subject:** RE: CYD Tripping on 26th July 2024

**Cyber Security Warning: This sender is from outside of the organisation. Please be cautious when opening the links or attachments.**

Hi Kanishka,

Response from site below:

Answers to his questions in red.

- Does the supply cables from DC1 & DC2 to Transpower equipment separated from the BZ cross trip input cables? **Yes, From drawing TP201757 sh22 DC 1 supply for bus zone is on cable number 22 from DC1 to P106. The BZ trip to Contact Energy protection from Transpower is from P109 to each unit protection panel M4 on cables 1306,2306,3306,4306.**
- If yes, how you think this protection relay assertions happened? **The protection relay is a SEL2440 with high impedance opto-isolator coupled inputs. A long cable connected to a high impedance input can build up a capacitance charge. We believe that the spike/collapse of the negative rail to earth from the disconnecter earth fault was just enough to enable this charge to discharge through the input and cause a false indication.**
- Is DC supply for the DIS473 provided through DC1 & DC2 panel by Contact or other connection point at BZ? **DIS473 is supplied from DC1 via M3 to GIS F1 not via any BZ point.**
- If possible please confirm the ownership/responsibility of below items (Contact or Transpower)
  - DC supply cables between DC1 & DC2 panels and Transpower equipment & relay supply panels **All DC (and AC ) supply cables to Transpower equipment are owned by Transpower. Contact ownership ends at the MCB in the distribution board.**
  - BZ cross trip input signal cables **Contact owns the cables that trip to contact owned equipment and trip BZ from contact owned equipment**

**Gerard Demler**  
 Transmission Manager  
 Generation and Development  
 Mob: 021721741



PO Box 10742, Wellington 6143  
 Level 2, Harbour City Tower  
 29 Brandon Street  
 Wellington, New Zealand  
[contact.co.nz](http://contact.co.nz)

**From:** Kanishka Fonseka  
**Sent:** Wednesday, 16 October 2024 3:31 pm  
**To:** Gerard Demler <Gerard.Demler@contactenergy.co.nz>  
**Cc:** Justine Park <Justine.Park@transpower.co.nz>  
**Subject:** RE: CYD Tripping on 26th July 2024

Hi Gerard,

Thanks for sending the logs and data.

Generator 2 log – just captured only the 6.00 to 6.56 logs only and won't show any data relevant to the event.

Generator 3 log - I don't see any input signal received during the event time. It's unclear how the G3 tripped.

**The Sequential data recordings supplied as requested have captured this event. If you are having trouble understanding how to interpret this data, some points to note are.**

- Relay sequential data recordings are 'sequential only' (not over a duration period like your scada event log). Event #1 is the last trigger of the recorder before the download time. All previous events are determined by what inputs & outputs have activated.
- The recordings are internally generated within the relay and therefore stamped only with the relay time. The relay is not time synchronised with system time. (relay time is set during maintenance but does 'drift' between maintenance periods.)
- The relay does not know what devices are wired to its inputs and outputs or its logic equations, only that they have been activated. (I have attached the relay logic diagram to help you understand what inputs have been received)
- By convention, on protection schemes out101 = trip 1 out102= trip 2

Can you please send me the combined SER event log with descriptions. (refer to attached drawings) I need logs and traces relevant to the event. Specially traces of BZtrip signal and BZtrip input logs received during the event day. There is no such thing as "traces of BZtrip signal". The log as supplied and explained above is the only record available pertaining to the activations that caused this event.

Regards,

**Kanishka Fonseka** | Power Systems Engineer  
 M 022 164 4536 | E: [kanishka.fonseka@transpower.co.nz](mailto:kanishka.fonseka@transpower.co.nz)  
 **TRANSPower**  
[transpower.co.nz](http://transpower.co.nz)

**From:** Kanishka Fonseka <Kanishka.Fonseka@transpower.co.nz>  
**Sent:** Thursday, 24 October 2024 3:58 pm  
**To:** Gerard Demler <Gerard.Demler@contactenergy.co.nz>  
**Cc:** Justine Park <Justine.Park@transpower.co.nz>; Vong (Nyuk-Min) Vong <Nyuk-MinVong.Vong@transpower.co.nz>  
**Subject:** RE: CYD Tripping on 26th July 2024

Hi Gerard,

This event investigation is now getting time critical and expect your responses for previous request (previous email regarding combined SER event log as well as clarification for the below queries **on or before 1<sup>st</sup> of November 2024**.

According to the letter dated 9<sup>th</sup> Aug 2024 to us with the subject '26 July Under-Frequency Event, can you please explain the "temporary protection relay sensitivity changes" carried out to mitigate the risk posed by the switching of DIS473 (earth fault)? **Applied 5 millisecond 'debounce' filter time on all trip inputs.**

As you have explained in previous clarification email (attached herewith) that line could build up a capacitive charge due to long cable connected to a high impedance input and discharge it inputting false indication due to reference change in negative rail. Please explain the precautions Contact has taken in these input to prevent maloperation from electrical noise? **Investigated to understand what inputs asserted and under what conditions. Consulted manufacturer and other industry experts. Applied 5 millisecond 'debounce' filter time on all trip inputs. Extensively tested new applied settings to ensure no maloperations. No mal-operation from "electrical noise" has been detected in this event investigation or considered in our mitigations.**

Has this relay input used a pull down resister? **No.**

What is the debounce setting used in this input? If any changes has done to these values after the event, please specify the pre and post event setting values. **No debounce settings, 5mS debounce setting**

We observed below (highlighted in yellow) occurrences of activating 432 BZ trip CCT2 fail indication. Please explain the reason for these indication operation? If Contact carried out any work around the circuit breaker during this time, please explain that as well. **This alarm is known as trip circuit supervision. The alarm occurs every time an active trip is applied to the CB trip coil. (ie a trip relay is picked up). This is a feature of the design of the trip circuit supervision and CB trip coil circuitry for these circuit breakers. This alarm is not related to the cause of this event but is merely a consequence of testing of the protection relays during the event investigations.**

NZ.SysAct.CYD	26-Jul-2024 07:21:55.000	CYD	432	G2	STATE	OPEN		
NZ.SysAct.CYD	26-Jul-2024 07:21:55.000	CYD	452	G3	STATE	OPEN		
NZ.SysAct.CYD	26-Jul-2024 07:21:56.000	CYD	G2	G2	STATE	OPEN		
NZ.SysAct.CYD	26-Jul-2024 07:21:56.000	CYD	G3	G3	STATE	OPEN		
NZ.SysAct.CYD	26-Jul-2024 07:21:57.000	CYD	220KV_BUS	220KV_BUS	HZ	49.1	49.3	LOW
NZ.SysAct.CYD	26-Jul-2024 07:22:03.000	CYD	220KV_BUS	220KV_BUS	HZ	49.2	49.3	LOW

**From:** Kanishka Fonseka <Kanishka.Fonseka@transpower.co.nz>  
**Sent:** Thursday, October 3, 2024 4:00 PM  
**To:** Mao Reyes <Mao.Reyes@transpower.co.nz>  
**Cc:** Justine Park <Justine.Park@transpower.co.nz>; Vong (Nyuk-Min) Vong <Nyuk-MinVong.Vong@transpower.co.nz>  
**Subject:** UFE on 26th July 2024

Hi Mao,

I'm working on this event to support market team and would like to request further more information as per below.

- AO claims that generators tripped due to earth fault in the DIS473 by protection relay assertions. How this could possible?
- Is Transpower DC supply to motors and protection relay signals segregated?
- Who owns/responsible for the cables
  - between Contact DC system and Transpower DC?
  - Bus zone cross trip input signal cables back to Contact?

Regards,  
**Kanishka Fonseka** | Power Systems Engineer  
 M 022 164 4536 | E: [kanishka.fonseka@transpower.co.nz](mailto:kanishka.fonseka@transpower.co.nz)  
 **TRANSPower**  
[transpower.co.nz](http://transpower.co.nz)

**From:** Mao Reyes <Mao.Reyes@transpower.co.nz>  
**Sent on:** Thursday, October 24, 2024 2:25:17 AM  
**To:** Kanishka Fonseka <Kanishka.Fonseka@transpower.co.nz>  
**CC:** Justine Park <Justine.Park@transpower.co.nz>; Vong (Nyuk-Min) Vong <Nyuk-MinVong.Vong@transpower.co.nz>; George Baildon <George.Baildon3@transpower.co.nz>; Stephanie Yearsley <Stephanie.Yearsley@transpower.co.nz>  
**Subject:** RE: UFE on 26th July 2024

Hi Kanishka

Thank you for your patience.

We had the service provider go to site to verify some of the information you require.

- As the GIS for Bay 470 is owned by Contact and we don't have drawings showing the DC supply to the Bay 470 GIS cubicles, this would imply that Contact own the 125V DC supply cable from their DC panel to the GIS cubicle.
- The cable with the trip circuit from our bus zone to Contacts protection panel is on our cable schedule which would imply it is owned by us.

On your first question, the cause of the generator tripping for this event appears to be a result of electromagnetic interference between the Contact DC supply cable and the Transpower bus zone tripping cable. These are long cable runs from the relay room to the powerhouse. The Contact Energy trip input from our bus zone relay should be robust enough that it does not operate from electromagnetic noise on the long cable run. Their equipment should not be issuing trips on occurrence of an earth fault. Transpower uses techniques to prevent a relay trip input from inadvertently tripping a reaker on switchyard long cable runs as is good industry practice.

AS/NZS 3000 provides guidelines for minimising electromagnetic conduction of cables. In particular, standard 3.9.11 provides that certain types of electrical installations may require minimization of electromagnetic interference arising from magnetic fields developed from current flowing in cables. This may be addressed by a selection of cables designed for low magnetic field emissions, installation of cables in enclosures that contain shield magnetic fields, or installation of cables in configurations that produce low magnetic fields.

**3.9.11 Electromagnetic interference**

Certain types of electrical installations, e.g. those containing sensitive electronic equipment or systems, may require minimization of electromagnetic interference arising from magnetic fields developed from current flowing in cables. This may be addressed by—

- (a) selection of cables designed for low magnetic field emissions; or

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154

- (b) installation of cables in enclosures that contain or shield magnetic fields; or
- (c) installation of cables in configurations that produce low magnetic fields.

NOTE: AS/NZS 3008.1 series details circuit configurations for the installation of parallel single-core cables in groups that produce reduced levels of magnetic field in comparison with other electrically symmetrical configurations.

Also we'd just like to add, Contacts' point of connection at Clyde are at the bus between the disconnectors (G1 = disconnector 413/415, G2 = 433/435, G3 = 453/455, G4 = 473/475). Main protection systems are required to electrically disconnect a faulted asset from the grid. Contacts "protection system" which is their protection cross trip relay operated to trip their generator(s). Their generating units G2 and G3 got disconnected, but there was no fault associated with those units' connection to the grid, and so it should not have tripped.

I understand you are still seeking further information around the event. If necessary we're happy to discuss over a meeting if that would make it easier.

Cheers

**MAO REYES**

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## APPENDIX B – TRANSPOWER GRID OWNER PROTECTION AND AUTOMATION INCIDENT ANALYSIS REPORT



## Protection and Automation Incident Analysis Report

### CYD-G2/G3 Tripping on 26/07/2024 at 07:21

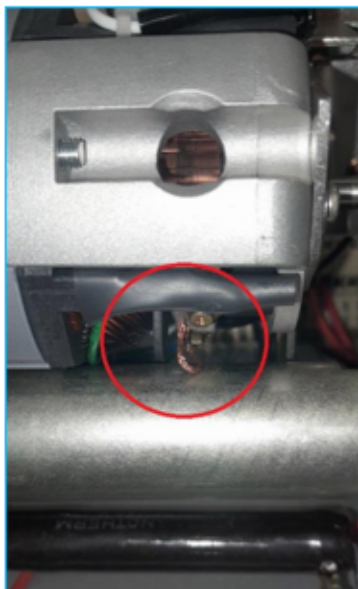
Prepared by	G Baildon	Prepared on	22/08/2024
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#### Fault Summary

CYD DIS473 was opened on 26/07/2024 7:21:53 am. CYD generators G2 & G3 tripped shortly after at 7:21:55 am.

The Service Provider has attended the site and found the cause and contributing factors for the CYD Generator tripping.

1. On operation of the CYD DIS473, the motor experienced a DC earth fault. Transpower own this disconnect, Contact have operational control. The cause of the motor DC fault was determined to be an exposed DC supply that was in contact with the manual crank pole. This appears to be a flaw in the build quality of the motors by the manufacturer which have recently been refurbished.



2. Contact generator protection tripped G2 & G3 at the same time this earth fault developed. We suspect that this is an issue with their protection not being secure during secondary DC earth faults. From our initial discussion with the Service Provider on site, there appears to be some best practice not followed in their secondary protection design. The trip input of the generator protection from out BZ trip does not appear to have a hold down resistor and may have picked up during the DC earth fault.



30

Contacts response to the tripping is as follows:

- Whether Contact has a DC earth fault monitoring device on the 125V DC system? **Yes we do**
- Are protection DC circuits and DC motor supply cables segregated? **Yes**
- On relay trip inputs, are shunt resistors used? **No**
- What was the cause of the tripping?  
**Primary cause, DC earth fault coming from Transpower disconnector(s) motor-drive-unit. Secondary effect being capacitively induced (by earth fault condition) assertions (inputs) occurring at SEL2440 protection relays. In particular the Bus Zone CB trip -and- Transformer OLTC Oil Surge trip.**

**Other Observations**

NA.

**Actions**

NA.

**Reference Files**

NA.

**Daily Operations Log**

By	Date - Time	Party	Subject	Description
SI	Fri 26/07 07:24	NCC	CYD	NCC - Advised - Advised of loss of frequency due to generator tripping, pass on any calls from EDBs to NCC. NGOC was opening DIS 473 under instruction from CCC at the time of the incident
SI	Fri 26/07 07:51	SI	CYD	Tripped - Phoned protection <del>808</del> to investigate CYD generator tripping
SI	Fri 26/07 15:41	SI	CYD	Tripped - TP Protection Engineer could not find any fault with the TP equipment and suspects the fault is within CCC's control. CCC have been made aware of this and they may contact our Protection Engineer to discuss options next week if needed.
SI	Sat 27/07 13:40	SI	CYD	Tripped - CCC instructed SI desk to operate the disconnectors for units G1 - G4 to see if they could find the reason for <u>yesterdays</u> tripping. It concluded only G4 Disconnector 473 caused an alarm when operated, and this will be investigated on Monday 29th July with TP Protection Engineers assistance. CCC to contact TP on Monday.





**Appendix B – Additional Information from PI**

**PI DTF Tags**

DFF tags contain before and after the event tags. Delete the before tag.

Tag Name	Date - Time	Zero (ms)	DTF Value

**PI SOE Tags**

Date/ Time	Zero (ms)	STN	CB	Circuit	Relay	Comment

**PI Alarm Tags**

Date - Time	Zero (ms)	STN	CB	Circuit	Relay	Comment
2024Jul26, 07:21:50.000	0	CYD	473	G4		POS OPEN ISSUED BY RCS
2024Jul26, 07:21:53.000	3000	CYD	473	G4		STATE MIDPOS
2024Jul26, 07:21:55.000	5000	CYD	552	T8-HV CB		REG D REG D AVR T/CH IN PROGRESS OPERATED
2024Jul26, 07:21:55.000	5000	CYD	473	G4		STATE OPEN BY RCS
2024Jul26, 07:21:55.000	5000	CYD	552	T8-HV CB		REG D REG D AVR T/CH IN PROGRESS RESET
2024Jul26, 07:21:55.000	5000	CYD	432	G2		STATE OPEN
2024Jul26, 07:21:55.000	5000	CYD	452	G3		STATE OPEN
2024Jul26, 07:21:56.000	6000	CYD		G2		STATE OPEN
2024Jul26, 07:21:56.000	6000	CYD		G3		STATE OPEN
2024Jul26, 07:21:57.000	7000	CYD				220KV BUS 220KV BUS HZ 49.1 49.3 LOW
2024Jul26, 07:22:03.000	13000	CYD				220KV BUS 220KV BUS HZ 49.2 49.3 LOW
2024Jul26, 07:22:06.000	16000	CYD				220KV BUS 220KV BUS HZ 49.4 49.3 NORMAL
2024Jul26, 07:22:06.000	16000	CYD	432			BZ BUS ZONE TRIP CCT 2 FAIL OPERATED
2024Jul26, 07:22:06.000	16000	CYD	452			BZ BUS ZONE TRIP CCT 2 FAIL OPERATED
2024Jul26, 07:22:12.000	22000	CYD				ACK:WENERGY 26/07/24 07:22:03 220KV BUS 220KV BUS FOR AREA(S): ISC DESP -ALARM D2A2AE2
2024Jul26, 07:22:12.000	22000	CYD	432	G2		ACK:WENERGY 26/07/24 07:21:55 FOR AREA(S): ISC DESP -ALARM D2A2AC7



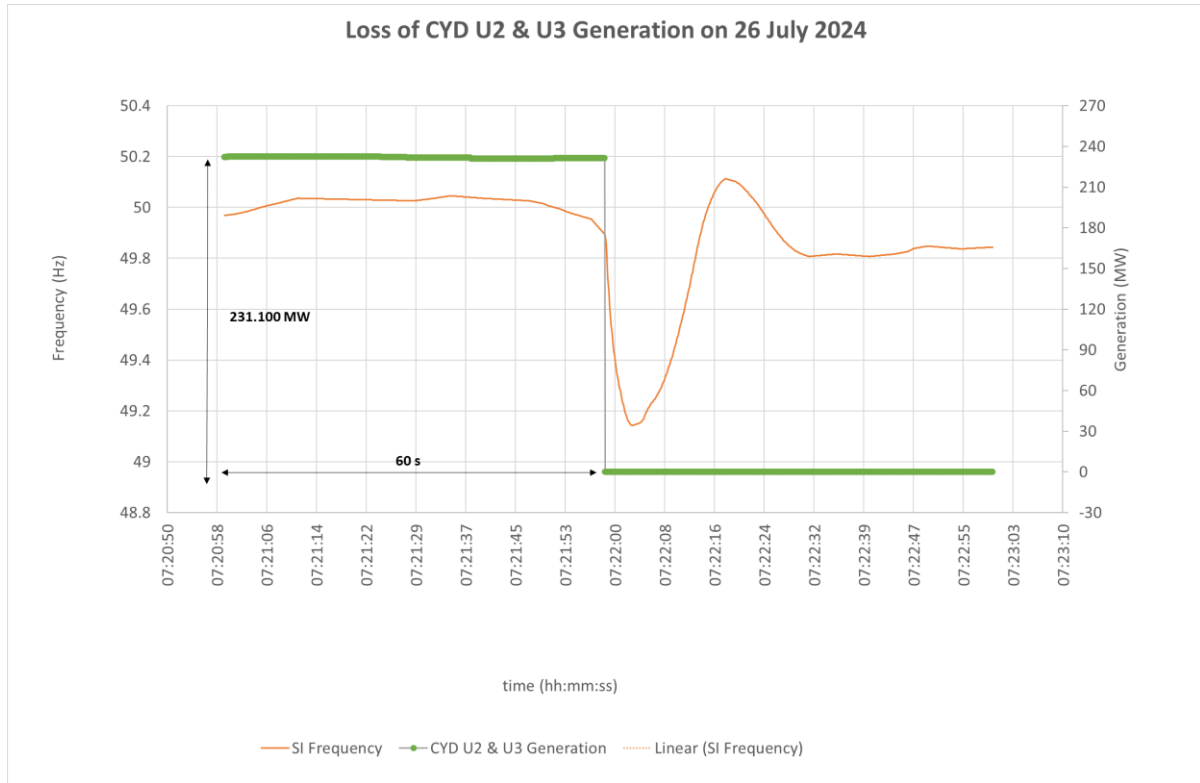
2024Jul26, 07:22:12.000	22000	CYD	452	G3		ACK:WENERGY 26/07/24 07:21:55 FOR AREA(S): ISC DESP -ALARM D2A2AC8
2024Jul26, 07:22:16.000	26000	CYD	452			ACK:RCS 26/07/24 07:22:06 BZ BUS ZON FOR AREA(S): ISC GRID -ALARM D2A2AF3
2024Jul26, 07:22:16.000	26000	CYD	432			ACK:RCS 26/07/24 07:22:06 BZ BUS ZON FOR AREA(S): ISC GRID -ALARM D2A2AF2
2024Jul26, 07:24:52.000	182000	CYD	412	G1		STATE CLOSED
2024Jul26, 07:24:53.000	183000	CYD		G1		STATE CLOSED
2024Jul26, 07:27:13.000	323000	CYD	452			DEL:RCS 26/07/24 07:22:06 BZ BUS ZON FOR AREA(S): ISC GRID -ALARM D2A2AF3
2024Jul26, 07:27:13.000	323000	CYD	432			DEL:RCS 26/07/24 07:22:06 BZ BUS ZON FOR AREA(S): ISC GRID -ALARM D2A2AF2

## Appendix 3: CHARTS

### System Frequency (South Island) and MW Trace 26<sup>th</sup> July 2024

#### South Island Frequency

32



## Appendix C Interpretation of causer

**causer**, in relation to an **under-frequency event**, means—

- (a) if the **under-frequency event** is caused by an interruption or reduction of **electricity** from a single **generator's** or **grid owner's asset** or **assets**, the **generator** or **grid owner**; unless—
  - (i) the **under-frequency event** is caused by an interruption or reduction of **electricity** from a single **generator's asset** or **assets** but another **generator's** or a **grid owner's** act or omission or property causes the interruption or reduction of **electricity**, in which case the other **generator** or the **grid owner** is the **causer**; or
  - (ii) the **under-frequency event** is caused by an interruption or reduction of **electricity** from a single **grid owner's asset** or **assets** but a **generator's** or another **grid owner's** act or omission or property causes the interruption or reduction of **electricity**, in which case the **generator** or other **grid owner** is the **causer**; or
- (b) if the **under-frequency event** is caused by more than 1 interruption or reduction of **electricity**, the **generator** or **grid owner** who, in accordance with paragraph (a), would be the **causer** of the **under-frequency event** if it had been caused by the first in time of the interruption or reduction of **electricity**; but
- (c) if an interruption or reduction of **electricity** occurs in order to comply with this Code, the interruption or reduction of **electricity** must be disregarded for the purposes of determining the **causer** of the **under-frequency event**