

# The Authority's draft determination of causer

All the papers w

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5 May 2022 under-frequency event  
Consultation paper

Submissions close: 5pm, 13 December 2022

Publishing date: 15 November 2022

## Executive summary

### **An under-frequency event occurred on 5 May 2022**

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

The purpose of this paper is to:

- (a) set out the Authority's draft determination of the causer for the 5 May 2022 UFE
- (b) consult with interested parties on the draft determinations.

### **The Authority's draft determination is that Meridian was the causer for the 5 May 2022 UFE**

The Authority's draft determination under clause 8.61 of the Code is that Meridian Energy Limited (Meridian), as a generator, was the causer of the UFE on 5 May 2022.

The reasons for the draft determination are:

- (a) the interruption/reduction of energy occurred at Units 1 and 7 at the Manapouri power station, which belongs to Meridian
- (b) no other asset was identified as having caused or potentially caused the UFE
- (c) in the system operator's view, Meridian is the causer of the UFE
- (d) in reply to a system operator letter, Meridian accepted that it was the causer

### **Submissions are invited from interested parties**

The Authority must consult with interested parties before making a final determination. Interested parties are invited to make a submission on the Authority's draft determination by 5 pm on 13 December 2022. The Authority will consider all submissions received and make a final determination on each UFE.

The Authority also invites comment on the system operator's calculations of the MW lost during the events, which the system operator uses for calculating the UFE charge.

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# 1 What you need to know to make a submission

## What this consultation paper is about

- 1.1 The purpose of this paper is to consult with interested parties on the Authority's draft determination that Meridian Energy Limited, as the generator that owns Manapouri Units 1 and 7, was the causer of the UFE on 5 May 2022 at 11:41 am.

## 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 [UFEconsultations@ea.govt.nz](mailto:UFEconsultations@ea.govt.nz) with "Consultation Paper—5 May 2022 under-frequency event" in the subject line.
- 1.3 If you cannot send your submission electronically, post one hard copy to either one of the addresses below, or fax it to 04 460 8879.

### Postal address

Submissions  
Electricity Authority  
PO Box 10041  
Wellington 6143

### Physical address

Submissions  
Electricity Authority  
Level 7, Aon Centre  
1 Willis Street  
Wellington

- 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
  - (c) provide a version of your submission that we can publish (if we agree not to publish your full submission).

- 1.5 If you indicate that part of your submission should not be published, someone from the Authority will discuss this with you before the Authority decides whether to not publish that part of your submission.

- 1.6 However, please note that all submissions that are received, including any parts that are not published, can be requested under the Official Information Act 1982. This means the Authority would be required to release material that it did not publish unless good reason existed under the Official Information Act to withhold it. Someone from the Authority would normally consult with you before releasing any material that you indicated should not be published.

## When to make a submission

- 1.7 Please deliver your submissions by **5pm** on Tuesday **13 December 2022**.
- 1.8 The Authority will acknowledge receipt of all submissions electronically. Please contact the Authority [info@ea.govt.nz](mailto:info@ea.govt.nz) or 04 460 8860 if you don't receive electronic acknowledgement of your submission within two business days.

## 2 Introduction

- 2.1 Clause 8.60 of the Code requires the system operator to investigate the causer of a UFE and provide a report to the Authority.
- 2.2 Clause 8.61(2) requires the Authority to publish a draft determination that states whether a UFE was caused by a generator or grid owner, and, if so, the identity of the causer. Clause 8.61(3) requires the Authority to give reasons for its findings in the draft determination.

## 3 The 5 May 2022 UFE draft determination

### **Meridian was the causer of the 5 May 2022 UFE**

- 3.1 The Authority's draft determination under clause 8.61 is that Meridian, as the generator that owns Manapouri Units 1 and 7, was the causer of the UFE on 5 May 2022 at 11:41 am.

### **The system operator investigated the causer of the UFE**

- 3.2 The system operator's report (dated June 2022) is attached as Appendix B.
- 3.3 The circumstances described in the report are summarised below:
  - (a) At 11:41 am Manapouri Units 1 and 7 tripped removing 242.97 MW of generation, the frequency fell to 48.98 Hz in the South Island and 49.21 Hz in the North Island.
  - (b) The frequency fall and the quantum of MW lost (greater than the 60 MW minimum) meant that a UFE, as defined in Part 1 of the Code, had occurred.
  - (c) Interruptible load and instantaneous reserves in the North and South Islands responded, returning the frequency to the normal band.
  - (d) Manapouri Units 1 and 7 tripped due to the maloperation of digital overspeed protection. Meridian believes this was caused by interference to the speed probes from electrical noise produced by the Unit 5 220kv cable sheaths which were left unearthed when the unit was returned to service. Meridian believes this is what caused the UFE.
  - (e) No other event or asset operation was identified as occurring at or around the time of the UFE.
  - (f) On 31 May 2022, the system operator wrote to Meridian setting out its view that Manapouri Units 1 and 7 tripped resulting in a loss of injection and requesting any information Meridian could provide. On 10 June 2022, Meridian agreed it was the causer.
  - (g) On 31 May 2022, the system operator requested the grid owner provide information on the circumstances of the UFE. On 14 June 2022, the grid owner provided some supporting information. The grid owner did not believe it (the grid owner) was the causer.

### **The Authority considered the circumstances of the UFE**

- 3.4 The Authority has considered the system operator's report and correspondence with Meridian and the grid owner. The Authority's reasons for the draft determination that Meridian is the causer are:
  - (a) A UFE occurred on 5 May 2022 at 11:41am when frequency dropped to 49.21 Hz in the North Island and to 48.98 Hz in the South Island.

- (b) The interruption/reduction of electricity occurred at the grid injection point for Manapouri Units 1 and 7, which belong to Meridian.
  - (c) No other asset was identified as having caused or potentially caused the UFE.
  - (d) The system operator and Meridian agree that Meridian was the causer of the UFE.
- 3.5 Having considered the relevant clauses of the Code, the Authority (based on the information available to us at this time) agrees with the system operator's findings on the 5 May 2022 UFE.

**Q1. Do you agree with the draft determination that Meridian Energy Limited is the causer of the under-frequency event on 5 May 2022 at 11:41am hours? If not, please advise your view on the causer and give reasons.**

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

- 4.1 Clause 8.61(4) of the Code requires the Authority to consult every generator, grid owner and other participant substantially affected by a UFE in relation to a draft determination. The Authority has allowed a consultation period of four weeks for this draft determination.
- 4.2 Accordingly, the deadline for submissions is 5 pm on 13 December 2022.
- 4.3 The Authority will consider submissions received and publish its final determination. Clauses 8.62 and 8.63 of the Code set out provisions relating to any disputes regarding the Authority's determination.

## 5 The system operator has calculated the MW lost during the event based on its investigations

- 5.1 The Code sets out how to calculate the event charge payable by the causer of a UFE. This in turn enables calculation of the rebates paid for UFEs (clauses 8.64 and 8.65 of the Code).
- 5.2 Central to the event charge calculation is determining the MW of injection lost at one or more grid injection points as a result of the UFE. The system operator determines the MW lost as part of its investigations into a UFE.
- 5.3 The system operator followed its procedure *PR-RR-017 Calculating the Amount of MW lost* to determine the MW value (provided to the clearing manager for calculating UFE charges).
- 5.4 The system operator has determined the loss of injection into the grid. The 5 May 2022 event was 242.97 MW at the grid injection point for Manapouri Units 1 and 7, resulting in an event charge of \$228,712.50.
- 5.5 The system operator's calculation of the MW lost is included in its report. The calculation does not form part of the Authority's draft determination. However, the Authority acknowledges that the calculation is central to determining the UFE charge payable by the causer, and therefore also to the rebate paid for a UFE. Accordingly, the Authority invites comment on the system operator's calculation of the MW lost.

**Q2. Do you agree with the system operator's calculation that 242.97MW was lost from the power system in the 5 May 2022 UFE? If not, please advise your view on the MW lost and give reasons.**

## Appendix A Format for submissions

Submitter	
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Question	Comment
<p>Q1. Do you agree with the draft determination that Meridian Energy Limited is the causer of the under-frequency event on 5 May 2022 at 11:41am? If not, please advise your view on the causer and give reasons.</p>	
<p>Q2. Do you agree with the system operator's calculation that 242.97MW was lost from the power system in the 5 May 2022 UFE? If not, please advise your view on the MW lost and give reasons.</p>	

Appendix B Causation report 5 May 2022

# Causation Report 5<sup>th</sup> May 2022 Under-Frequency Event

System operator event 4277

June 2022



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**IMPORTANT**

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**Contact Details**

Address: Transpower New Zealand  
Ltd 22 Boulcott Street  
PO Box 1021  
Wellington  
New  
Zealand

Telephone: +64 4 495 7000

Email: [system.operator@transpower.co.nz](mailto:system.operator@transpower.co.nz)

Website: <http://www.transpower.co.nz>

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## PURPOSE

On 5<sup>th</sup> May 2022 a reduction of energy into the power system caused the system frequency in the North and South Islands 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:

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- 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 11:41:46 on 5<sup>th</sup> May 2022 Meridian Energy's Manapouri Station Units 1 and 7 (**Manapouri Units 1 and 7**) tripped. *Note Units 5 and 6 at Manapouri Station also tripped, but the system operator does not consider these Units to have impacted the frequency and has excluded them from this investigation.*

The disconnection of generation from Manapouri Units 1 and 7 removed 242.97 MW of injection into the power system.

At 11:41:49 the South Island frequency fell to 48.98 Hz and at 11:41:50 the North Island frequency fell to 49.21 Hz. The North and South Island frequencies individually falling below 49.25 Hz constitutes an under-frequency event, as defined in the Code.

Meridian has stated that it believes the tripping of Manapouri Units 1 and 7 was the cause of the under-frequency on 5<sup>th</sup> May 2022.

Investigation into the tripping and other system events supports Meridian's position that the trip of Manapouri Units 1 and 7 caused the under-frequency event.

Accordingly, the system operator recommends Meridian be found as the causer of the under-frequency event on 5<sup>th</sup> May 2022.

## SYSTEM EVENTS – 5<sup>TH</sup> MAY 2022

### Prior to the under-frequency event

According to the grid owner, there were no protection operations on any grid assets in the vicinity of Manapouri Station either before or after Manapouri Units 1 and 7 tripped that may have contributed to the frequency falling below 49.25 Hz. The grid owner’s PI data showed that the Frequency Keeping Control modulation on the HVDC was active when the tripping of Manapouri Units 1 and 7 occurred, and the HVDC reduced transfer to support the South Island AC system after the tripping.

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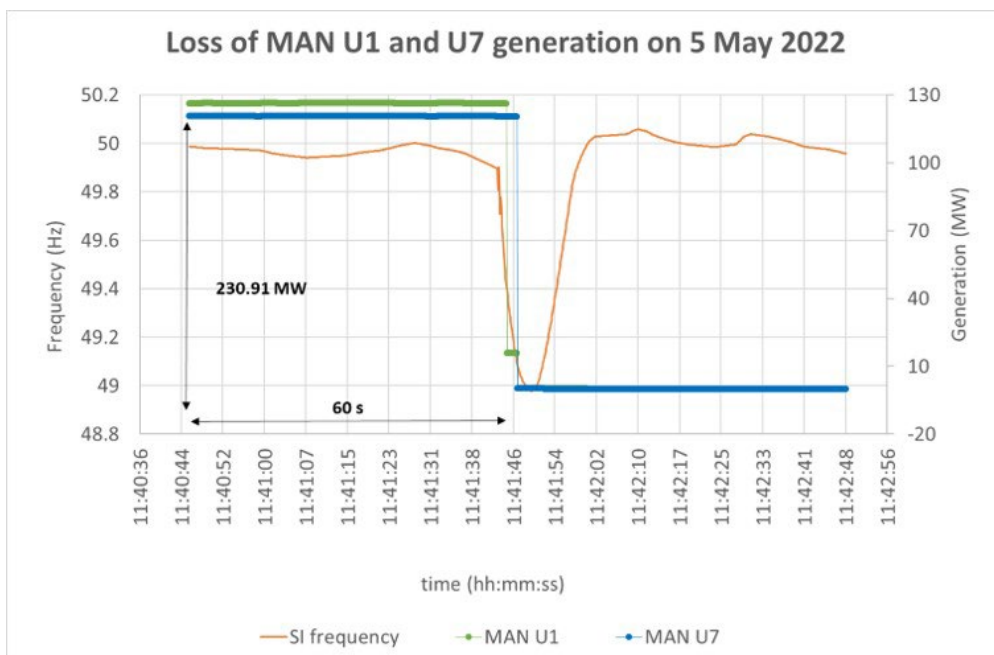
### The under-frequency event

According to Meridian, Manapouri Units 1 and 7 tripped due to the maloperation of digital overspeed protection. Meridian believes the maloperation was caused by interference to the speed probes from severe electrical noise produced by the Unit 5 220kV cable sheaths, which were inadvertently left unearthed when the unit was returned to service.

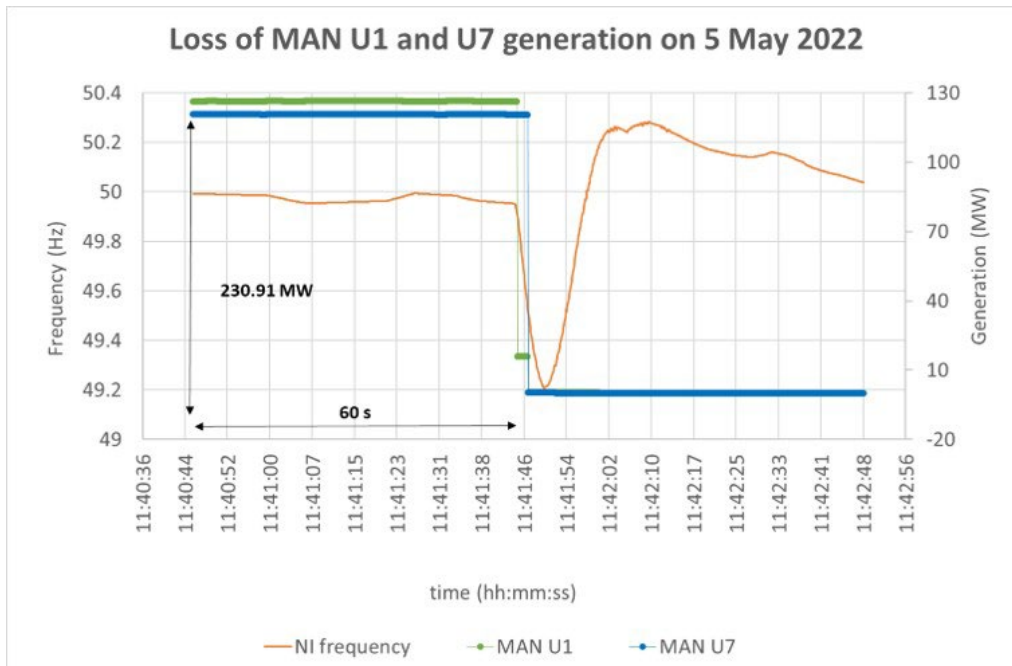
At 11:41:46 the disconnection of Manapouri Units 1 and 7 removed 242.97 MW of generation injection into the power system. Consequently, this reduced the system frequency in the South Island below 49.25 Hz at 11:41:46 (49.249 Hz) and in the North Island at 11:41:49 (49.247 Hz). The frequency in the South Island reduced to 48.98 Hz at 11:41:49 and in the North Island it reduced to 49.21 Hz at 11:41:50.

Meridian confirmed the MW lost as 242.97 and provided supporting SCADA data in its response to the system operator on 10<sup>th</sup> June 2022. The system operator’s graphs below do not precisely record the value of MW lost. This is because the system operator’s SCADA data does not have the same resolution as Meridian’s data (the system operator interpolates some of its data points).

### South Island Frequency



## North Island Frequency



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### After the under-frequency event

At the time of the event, the system operator had dispatched:

- North Island (generation) instantaneous reserve providers to be available to provide 207.05 MW FIR and 285.25 MW SIR;
- North Island interruptible load providers to be available to trip 78.59 MW FIR and 125.17 MW SIR; and
- South Island (generation) instantaneous reserve providers to be available to provide 86.56 MW FIR and 125.17 MW SIR.

These reserve providers responded, returning the frequency to the normal band within 8 seconds.

Interruptible load providers are not required to respond until the frequency drops below 49.20 MW. Five interruptible load providers were scheduled for dispatch, one responded in full and four had partial responses, due to local frequency discrepancies being sufficiently close to 49.20 Hz. 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. The response of the interruptible load providers was consistent with their contractually agreed trip settings.

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

## RATIONAL FOR RECOMMENDATION

### Factors considered

Only one event occurred in close proximity to the North Island frequency falling below 49.25 Hz, namely the tripping of Manapouri Units 1 and 7 at 11:41:46.

Accordingly, assessment of this information confirms that only the tripping of Manapouri Units 1 and 7 can be linked with the North and South Island frequencies falling below 49.25Hz.

Meridian and the grid owner were both asked if they considered themselves the causer of the under-frequency event.

Meridian confirmed that the tripping of Manapouri Units 1 and 7 caused the under-frequency event.

The grid owner does not believe it caused the under-frequency event.

## 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:

$$EC = ECR * (\sum_y (INT_{ye} \text{ for all } y) - INJ_d)$$

where

EC is the event charge payable by the causer  
ECR is \$1,250 per MW

INJ<sub>d</sub> is 60 MW

INT<sub>ye</sub> 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<sub>d</sub> values are constants the values to calculate and complete the formula are y and INT<sub>ye</sub>.

*To establish the amount of MW lost, SCADA data was extracted for the 60 seconds prior to the North and South Island frequencies reaching 49.25 Hz for generation into the Manapouri grid injection point. However, the system operator's SCADA data does not have the same resolution as Meridian's data (the system operator interpolates some of its data points). Meridian confirmed the MW lost causing the North and South Island frequencies to fall below 49.25 Hz as 242.97 MW and provided its supporting SCADA data. The system operator is comfortable to rely on Meridian's more accurate SCADA data.*

Using the event charge formula the calculation is as

follows: Event Charge = \$1250 \* (242.97MW – 60MW)

Event Charge = \$228,712.50



# Appendix 1: CORRESPONDENCE

## 1.1 CONFIRMATION OF EVENT NOTICE

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### Customer Advice Notice

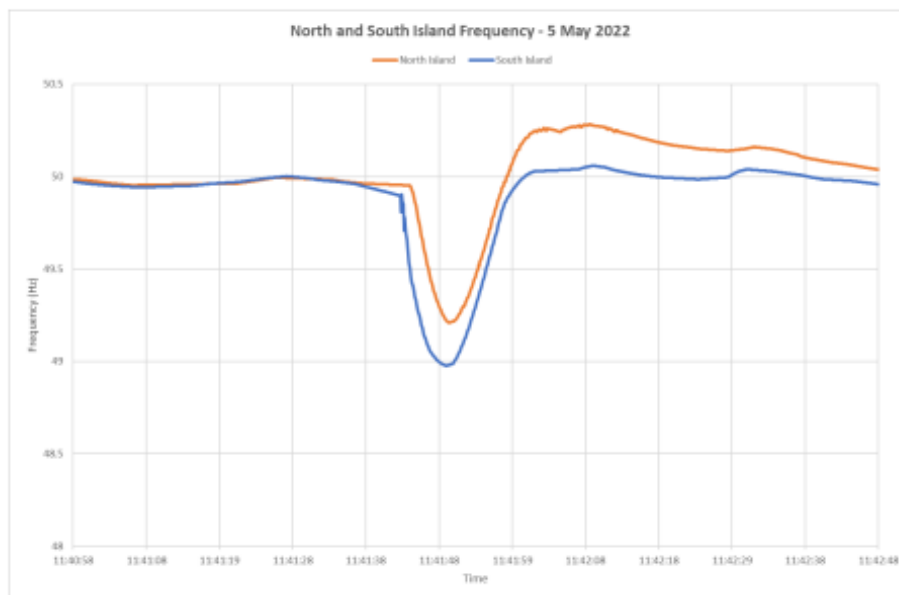
**To:** CAN NZ Participants, cm@nzx.com      **From:** The System Operator  
**Sent:** 10-may-2022 16:27      **Telephone:** 0800 488 500  
**Ref:** 4329608470      **Email:** NMData@transpower.co.nz

Revision of:

#### Under-Frequency Event Confirmation

The system operator wishes to advise market participants of the under-frequency event which occurred in the North Island and South Island on 05 May 2022.

<b>Event ID</b>	4277
<b>Affected Islands:</b>	North Island & South Island
<b>North Island Minimum Frequency:</b>	49.21 Hz
<b>Time (start of UFE):</b>	11:41:49
<b>Time (of min. frequency):</b>	11:41:50
<b>South Island Minimum Frequency:</b>	48.98 Hz
<b>Time (start of UFE):</b>	11:41:46
<b>Time (of min. frequency):</b>	11:41:49



## 1.2 SYSTEM OPERATOR REQUEST FOR INFORMATION - MERIDIAN

**TRANSPower**

Waikoukou  
22 Boulcott Street  
PO Box 1021, Wellington  
New Zealand  
Telephone +64-4-590 7000  
Facsimile: +64-4-495 7100  
[richard.renouf@transpower.co.nz](mailto:richard.renouf@transpower.co.nz)

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31 May 2022

Simone O'Loughlin  
Meridian Energy  
PO Box 2146  
Christchurch

Dear Simone,

**5<sup>th</sup> May 2022 North and South Island Under-Frequency Event**

At 11:41 on 5<sup>th</sup> May 2022 an under-frequency event occurred in the North and South Islands. 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 5<sup>th</sup> May 2022.
- We have assessed the MW lost during the event as 230.91 MW at Manapouri U1 and U7 (we have not included any MW lost from U5 or U6). 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,

A handwritten signature in blue ink, appearing to read 'RJR'.

**Richard Renouf**  
SO Compliance & Impartiality Manager

## 1.3 SYSTEM OPERATOR REQUEST FROM INFORMATION – GRID OWNER

**TRANSPower**

Waikoukou  
22 Boulcott Street  
PO Box 1021, Wellington  
New Zealand  
Telephone +64-4-590 7000  
Facsimile: +64-4-495 7100  
[richard.renouf@transpower.co.nz](mailto:richard.renouf@transpower.co.nz)

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31 May 2022

Mao Reyes  
Grid Compliance Manager  
Grid Owner  
Transpower  
Wellington

Dear Mao,

### 5<sup>th</sup> May 2022 North and South Island Under-Frequency Event

At 11:41 on 5<sup>th</sup> May 2022 an under-frequency event occurred in the North and South Islands. 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 5<sup>th</sup> May 2022.
- 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 'RJR'.

**Richard Renouf**  
SO Compliance & Impartiality Manager

## 1.4 MERIDIAN RESPONSE



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10 June 2022

Richard Renouf  
Compliance and Impartiality Manager  
Transpower System Operator

By email: [Richard.renouf@transpower.co.nz](mailto:Richard.renouf@transpower.co.nz)

Dear Richard

**Re: 5<sup>th</sup> May 2022 North and South Island Under Frequency Event (UFE)**

I refer to your email dated 2<sup>nd</sup> June 2022 relating to the UFE on the 5<sup>th</sup> May 2022. In response to your questions;

***Can you provide information regarding the event and what you believe may have caused the UFE to occur.***

Manapouri units 1, 5, 6 and 7 tripped at approximately 11:41am on the 5<sup>th</sup> May 2022 due to maloperation of digital overspeed protection. Meridian believes that maloperation was caused by interference to the speed probes from severe electrical noise produced by the Unit 5 220kV cable sheaths, which were inadvertently left unearthed when the unit was returned to service.

***Transpower has assessed the MW lost as 230.91MW from Manapouri U1 and U7 (MW lost from U5 and U6 are not considered to have impacted frequency and are excluded). Please can Meridian confirm this assessment or provide data that indicates a different value.***

If U5 and U6 are excluded, Meridian has assessed the MW lost during the event as 242.97MW (U1 and U7 only) using the methodology defined in Section 4.2 of the Transpower PR-RR-017 Providing Under Frequency Event Causer Recommendations procedure.

***Causer of the under-frequency event as per the Code.***

Meridian considers it (Manapouri U1 and U7) was the causer of the 5<sup>th</sup> April 2022 North and South Island UFE.

Yours sincerely

Simone O'Loughlin  
Compliance and Property Relationship Manager

## 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)

14 June 2022

14

Richard Renouf  
Compliance and Impartiality Manager  
System Operations  
Transpower  
Wellington

Dear Richard

#### 5<sup>th</sup> May 2022 North and South Island Under-Frequency Event

Thank you for your letter dated 31 May 2022 regarding the under-frequency event that occurred on 5<sup>th</sup> May 2022 in the North and South Islands. My understanding of the event is as follows:

- At 11:41 on 5<sup>th</sup> May 2022 Manapouri units 1 and 7 tripped, resulting in an under-frequency event occurring in the North and South Islands.
- Market participants were notified by a frequency excursion notice issued at 12:01 on 5<sup>th</sup> May, that Manapouri generation had tripped and that the North and South Islands' frequency had fallen to 49.21Hz and 48.97Hz, respectively.
- A customer advice notice issued at 16:27 on 10<sup>th</sup> May confirmed that an under-frequency event occurred in the North (11:41:49) and South (11:41:46) Islands on 5<sup>th</sup> May 2022.
- There were no protection operations of any grid assets in the vicinity of Manapouri either before or after Manapouri units 1 and 7 tripped that may have contributed to the frequency falling below 49.25Hz.
- PI data shows that the Frequency Keeping Control modulation on the HVDC was active when the tripping of Manapouri units 1 and 7 occurred, and the HVDC reduced transfer to support the South Island AC system after the tripping.

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.

Yours sincerely

**Mao Reyes**  
Grid Compliance Manager

System Frequency (South and North Islands) and MW Trace 5<sup>th</sup> May 2022

