The Authority's draft determination of causer

4 February 2020 under-frequency event

Consultation paper

Submissions close: 5pm, 9 February 2021

12 January 2021

Executive summary

An under-frequency event occurred on 4 February 2020

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 MW injected into the grid. The Electricity Industry Participation Code 2010 (Code) requires us to determine the causer (as defined in the Code) of a UFE and sets the process for making the determination (clause 8.61).

The purpose of this paper is to:

(a) set out our draft determination of causer for the 4 February 2020 UFE

(b) consult with interested parties on the draft determinations.

Our draft determination is that Genesis is the causer for the 4 February 2020 UFE

Our draft determination under clause 8.61 of the Code is that Genesis Energy Limited (Genesis), as a generator, was the causer of the UFE on 4 February 2020.

The reasons for the draft determination are:

(a) the interruption/reduction of energy occurred at Unit 4 at the Huntly power station, which belongs to Genesis

(b) no other asset was identified as having caused or potentially caused the UFE

(c) in the system operator's view, Genesis is the causer of the UFE

(d) in reply to a system operator letter, Genesis has accepted that it was the causer.

Submissions are invited from interested parties

We 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 Tuesday 9 February 2021. We will consider all submissions received and make a final determination on each UFE.

We also invite comment on the system operator's calculations of the megawatts (MW) lost during the event, which the system operator uses for calculating the UFE charge.

Contents

2 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 Genesis Energy Limited, as the generator that owns Huntly Unit 4, was the causer of the UFE on 4 February 2020 at 23.33 hours.

How to make a submission

1.2 Our 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 UFE.consultations@ea.govt.nz with "Consultation Paper—4 February 2020 under-frequency event" in the subject line.

1.3 If you cannot send your submission electronically, post one hard copy to either of the addresses below, or fax it to 04 460 8879.

Postal address	Physical address
Submissions Electricity Authority PO Box 10041 Wellington 6143	Submissions Electricity Authority Level 7, Harbour Tower 2 Hunter Street Wellington

1.4 Please note we want to publish all submissions we receive. If you consider that we 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 there is part of your submission that should not be published, we will discuss with you before deciding whether to not publish that part of your submission.

1.6 However, please note that all submissions we receive, including any parts that we do not publish, can be requested under the Official Information Act 1982. This means we would be required to release material that we did not publish unless good reason existed under the Official Information Act to withhold it. We would normally consult with you before releasing any material that you said should not be published.

When to make a submission

1.7 Please deliver your submissions by **5pm** on Tuesday **9 February 2021**.

1.8 We will acknowledge receipt of all submissions electronically. Please contact the Authority 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 us.

2.2 Clause 8.61(2) requires us 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 us to give reasons for our findings in the draft determination.

3 The 4 February 2020 UFE draft determination

Genesis was the causer of the 4 February 2020 UFE

3.1 Our draft determination under clause 8.61 is that Genesis, as the generator that owns Huntly Unit 4, was the causer of the UFE on 4 February 2020 at 23.33 hours.

The system operator investigated the causer of the UFE

3.2 The system operator's report (dated March 2020) is attached as Appendix B.

3.3 The circumstances described in the report are summarised below:

(a) At 23:04 on 4 February 2020, while Huntly Unit 4 was on load, the start-up standby feed pump was started.

(b) At 23:31 the grid owner removed the Pakuranga-Whakamaru 1 220 kV circuit at the request of the system operator to aid in the management of voltages.

(c) At 23:31 Genesis Energy claimed a bona fide to reoffer the dispatch for Huntly Unit 4 down to 140 MW energy and 0 MW reserves. Unit 4 was struggling to provide energy as an issue had occurred with the routine operation of the start-up standby feed pump.

(d) At 23:33 Huntly Unit 4 tripped removing 182.5 MW of generation, the frequency fell to 49.20 Hz in the North Island and 49.34 Hz in the South Island.

(e) 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.

(f) Interruptible load and instantaneous reserves in the North Island responded, returning the frequency to the normal band within 35 seconds.

(g) 0.25 seconds after Huntly Unit 4 tripped, a transformer at the grid owner's North Makarewa substation tripped. This transformer is geographically and electrically distant from Huntly Unit 4.

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

(i) On 13 February 2020, the system operator wrote to Genesis setting out its view that Huntly Unit 4 tripped resulting in a loss of injection and requesting any information Genesis could provide. On 28 February 2020, in reply to the system operator, Genesis agreed it was the causer.

(j) On 13 February 2020, the system operator requested the grid owner provide information on the circumstances of the UFE. On 5 March 2020, in reply to the system operator, the grid owner provided some supporting information. The grid owner didn't believe it was the causer.

(k) On 11 March 2020, the system operator wrote to Genesis confirming 182.5MW was lost. Genesis acknowledged and accepted the letter on the same day.

We considered the circumstances of the UFE

3.4 We have considered the system operator's report and correspondence with Genesis and the grid owner. Our reasons for the draft determination that Genesis is the causer are:

(a) a UFE occurred on 4 February 2020 at 22.33 hours when frequency dropped to 49.20 Hz in the North Island

(b) the interruption/reduction of electricity occurred at the grid injection point for Huntly Unit 4, which belongs to Genesis

(c) no other asset was identified as having caused or potentially caused the UFE

(d) the system operator and Genesis agree that Genesis was the causer of the UFE.

3.5 Having considered the relevant elements of the Code, we (based on the information available to us at this time) agree with the system operator's findings on the 4 February 2020 UFE.

Q1. Do you agree with the draft determination that Genesis Energy Limited is the causer of the under-frequency event on 4 February 2020 at 23.33 hours? If not, please advise your view on the causer and give reasons.

4 We will consider submissions and make a final determination

4.1 Clause 8.61(4) of the Code requires us to consult every generator, grid owner and other participant substantially affected by a UFE in relation to a draft determination. We have allowed a consultation period of four weeks for this draft determination.[1]

4.2 Accordingly, the deadline for submissions is 5 pm on 9 February 2021.

4.3 We will consider submissions received and publish the Authority's final determination. Clauses 8.62 and 8.63 of the Code set out provisions relating to any disputes regarding our 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 Clause 8.64 of 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.

[1] The Authority discusses its approach to setting consultation periods for draft determinations in its consultation on the 8 September 2016 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 4 February 2020 event was 182.5 MW at the grid injection point for Huntly Unit 4, resulting in an event charge of $153,125.

5.5 The system operator's calculation of the MW lost is included in its report. The calculation doesn't form part of the Authority's draft determination. However, we acknowledge 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, we invite comment on the system operator's calculation of the MW lost.

Q2. Do you agree with the system operator's calculation that 182.5 MW was lost from the power system as a result of the 4 February 2020 UFE? If not, please advise your view on the MW lost and give reasons.

Appendix A Format for submissions

Submitter	

Question		Comment
Q1.	Do you agree with the draft determination that Genesis Energy Limited is the causer of the under-frequency event on 4 February 2020 at 23.33 hours? If not, please advise your view on the causer and give reasons.	
Q2.	Do you agree with the system operator's calculation that 182 MW was lost from the power system as a result of the 4 February 2020 UFE? If not, please advise your view on the MW lost and give reasons.	

Appendix B Causation report 4 February 2020 under-frequency event

Causation Report
4 February 2020
Under-Frequency Event

System operator event 3952

March 2020

Keeping the energy flowing




TRANSPOWER

Transpower New Zealand Limited The National Grid

Version	Date	Change
1.0	17 March 2020	Initial draft
1.1	20 March 2020	Final Report
1.2	02 November 2020	Missing page of Genesis letter inserted

	Position	Date
Prepared By:	Scott Avery, Risk and Compliance Manager, Operations	March 2020
Reviewed By:	Matthew Copland, System operator Power Systems Manager	March 2020

IMPORTANT

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

Website: *http://www.transpower.co.nz*

PURPOSE

On Tuesday 4 February 2020 a reduction of energy into the power system caused the system frequency in the North Island to fall below 49.25 Hz, resulting in an under-frequency event.

As per clause 8.60 of the Electricity Industry Participation Code (Code), Transpower as system operator investigated this event to assist the Electricity Authority in determining a causer for the under-frequency event.

The results of this investigation report are prepared under clause 8.60(5) of the Code, provided to the Electricity Authority, and relating to each identified under-frequency event includes:

- Whether in Transpower's view each under-frequency event was caused by the grid owner or a generator and identifies that potential causer;
- The reasons for forming this view;
- The information considered in reaching this view.

EXECUTIVE SUMMARY

At 23:33 on 4 February 2020 Genesis Energy's Huntly Station Unit 4 generator (Huntly Unit 4) tripped.

At 23:33 the North Island frequency fell to 49.20 Hz, and the South Island frequency fell to 49.34 Hz.

The North Island frequency falling below 49.25 Hz constitutes an **under-frequency event** as defined by the Code.

The disconnection of Huntly generation from Huntly Unit 4 removed 182.5 MW being injected into the power system.

Genesis Energy have stated that they believe that the tripping of Huntly Unit 4 was the cause of the under-frequency on 4 February 2020.

Investigation into the tripping and other system events supports Genesis's position that the trip of Huntly Unit 4 caused the under-frequency event.

As a result, the system operator recommends that Genesis Energy be found as the causer for the under-frequency event on 4 February 2020.

SYSTEM EVENTS - 4 FEBRUARY 2020

Prior to the under-frequency event

The weather was relatively settled on 4 February 2020, with no adverse weather conditions reported in the North Island. No weather watches or warnings were issued for New Zealand from 3 February to 5 February 2020. Given the weather conditions at the time, there is no indication that weather had any role to play in this under-frequency event.

At 21:11 the system operator's dispatch compliance alarm identified that the Huntly Block Dispatch Group was not meeting its dispatch. The alarm identifies any generator or block dispatch group that is, for more than 10 minutes and more than 30 MW from its dispatched setpoint. The Huntly Block Dispatch Group was dispatched to 546.24 MW at 21:01.

It was noted the Huntly Block Dispatch Group was 78 MW over its dispatched setpoint and that Huntly Unit 4 within the block appeared to be the cause. The Genesis control room were contacted, the Genesis operator indicated their generation was coming down but would investigate.

With respect to HLY Unit 4 being 78MW off dispatch at 21:11:
At 21:00 Unit 4 was dispatched from 230MW to 123MW, a large step change of 107MW. Dispatch changes should be limited to five times the ramp rate/min for Rankine units. This did not occur and was not identified by either System Operator or Genesis staff at the time. The unit reduced load to its dispatched value at the appropriate ramp rate.

Genesis have since advised:

The issue of being over dispatch does not relate to the under-frequency event and is an operational matter which has been addressed by the system operator and Genesis Energy.

At 23:31 the grid owner removed the Pakuranga-Whakamaru 1 220 kV circuit at the request of the system operator. The removal of this circuit is used to aid in the management of voltages in a lightly loaded system. This is a normal activity and has not been linked with the trip of any other asset or generator in the past. The removal of the circuit occurred 2 minutes prior to the trip of Huntly Unit 4. In the system operator's view, the removal of this circuit is sufficiently distant both in time and location unlikely to have had any influence on the tripping of Huntly Unit 4.

The under-frequency event

At 23:31 the National Coordination Centre's energy co-ordinator was contacted by the Genesis controller. Examination of the control voice tapes indicates that Genesis Energy claimed a bona fide to reoffer the dispatch for Huntly Unit 4 down to 140 MW energy and 0 MW reserves. Information from Genesis indicates that at that time Unit 4 was struggling to provide energy as an issue had occurred with the routine operation of the Start-up Standby Feed Pump (SSFP).

The SSFP needs to be run for 30 minutes every 21 days. The running of the SSFP can be performed with the unit on or offload. At 23:04 on 4 February 2020, while Huntly Unit 4 was on load, the SSFP was started.

During the runup the SSFP experienced a sequence deviation which impacted Huntly Unit 4's Main Boiler Feed Pump governor valves. This deviation meant that the boiler drum level decayed, prompting the call to the system operator to claim a bona fide to re offer Unit 4.

Attempts were made by Genesis Energy to address the decaying boiler drum level, these failed and Huntly Unit 4 tripped.

At 23:33:35 the disconnection of Huntly Unit 4 removed 182.5 MW of generation injection into the power system and as a consequence, reduced the system frequency to 49.20 Hz in the North Island and 49.34 Hz in the South Island.

Date	Time	Minimum Hz	Island
04-Feb-2020	23:33:35	49.20	North

Date	Time	Maximum Hz	Island
04-Feb-2020	23:33:45	50.46	North

Notified frequency levels 4 February 2020

After the under-frequency event

Interruptible load and instantaneous reserves in the North Island responded, returning the frequency to the normal band within 35 seconds. Performance of the interruptible load and instantaneous reserve providers is assessed by the system operator every under-frequency event. This is to assure that these providers are meeting ancillary service contracts. Assessment showed that all ancillary service contracts were met satisfactorily by all providers.

Immediately after the trip of Huntly Unit 4 a transformer at the grid owner's North Makarewa (NMA) substation tripped. This transformer is located in the bottom of the South Island and is both geographically and electrically distant from Huntly Unit 4. The timing of these events was very close but information from the grid owner shows that Unit 4 tripped 0.25 of a second before the NMA transformer.

The grid owner has confirmed that there is a known issue with the restricted earth fault element on the transformers' differential protection tripping in response to other trips on the grid.

A similar tripping in 2019 of a transformer at Invercargill (INV) was investigated by the grid owner, though a definitive explanation for that protection tripping has yet to be established. The grid owner continues to investigate the restricted earth fault element with the relay manufacturer and believes that it is limited to one type of relay. The grid owner has desensitised six of this type of relay to reduce the likelihood of maloperation. This desensitization does not impact the performance of the protection. Two further relays are to be desensitised and are dependent on planned outages to complete the work.

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

A number of events occurred in close proximity to the North Island frequency falling below 49.25 Hz, these include;

- Removal of the grid owner's Pakuranga-Whakamaru 1 220 kV circuit at 23:30
- Tripping of Genesis Energy's Huntly Unit 4 at 23:33;
- Tripping of the grid owner's transformer at North Makarewa at 23:33.

Information has been sought from both Genesis Energy and the grid owner in relation to these events. Assessment of the information provided conforms that only the tripping of Huntly Unit 4 can be linked with the North Island frequency falling below 49.25Hz.

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

Genesis Energy state that the tripping of Huntly Unit 4 caused the under-frequency event.

The grid owner does not believe that they could be a causer of the under-frequency event on 4 February 2020.

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. Transpower as system operator follows procedure 'Calculating the Amount of MW lost' (PR-RR-017) to determine this.

This procedure follows the formula set out under section 8.64 of the Code for evaluating 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 * (∑y (INTye for all y) – INJd)

where

EC	is the **event charge** payable by the causer
ECR	is $1,250 per **MW**
INJd	is 60 **MW**
INTye	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 INJd values are constants the values to calculate and complete the formula are y and INTye.

To establish the amount of MW lost, SCADA data was extracted for the 60 seconds prior to the frequency reaching 49.25 Hz for generation into the Huntly grid injection point.

After evaluation, the amount of MW lost causing the frequency to fall below 49.25 Hz was determined to be 182.5 MW.

Using the event charge formula the calculation is as follows:

Event Charge = $1250 * (182.5MW – 60MW)

Event Charge = $153,125

Appendix 1: CORRESPONDENCE

1.1 CONFIRMATION OF EVENT NOTICE

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TRANSPOWER

Waikoukou
22 Boulcott Street
PO Box 1021
Wellington 6140
New Zealand
www.transpower.co.nz

Cara Dunford
Tel: (04) 04 590 6057
Cara.dunford@transpower.co.nz

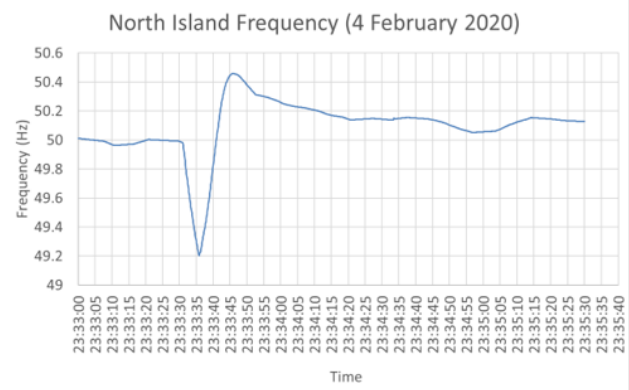
Date: 5 February 2020

To: Market Participants
cc: Clearing Manager
From: System Operator

Under-Frequency Event Confirmation

The System Operator wishes to advise market participants of the under-frequency event which occurred in the North Island on 4 February 2020.

Event ID	3952
Affected Islands:	North Island
North Island Minimum Frequency:	49.20 Hz
Time (start of UFE):	23:33:35
Time (of min. frequency):	23:33:35



Market Operations

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

1.2 SYSTEM OPERATOR REQUEST FOR INFORMATION – GENESIS ENERGY

TRANSPOWER

Waikoukou
22 Boulcott Street
PO Box 1021
Wellington 6140
New Zealand
P 64 4 495 7000
F 64 4 495 7100
www.transpower.co.nz

Scott Avery
Tel: (04) 590 6144
Fax: (04) 495 7154

13 February 2020

Steve Leppien
Genesis Energy
Private Bag 3131
Hamilton

Dear Steve,

4 February 2020 North Island Under-Frequency Event

At 23:33 on 4 February 2020, an under-frequency event occurred in the North Island. We are investigating the event and require information relating to several aspects of the event.

- We have identified that prior to the UFE event that:
  - At 21:11 Huntly Unit 4 was 78 MW off dispatch;
  - At 23:31 the Genesis control room contacted the National Coordination Centre claiming a bona-fide for Huntly Unit 4; and
  - Huntly Unit 4 tripped

  Could you provide information regarding these events and if you believe any of these may have played a part in the reduction of energy causing the under-frequency event on 4 February 2020.

- We have assessed the MW lost during this event as 182.2 MW at Huntly. 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 please consider and indicate whether or not you could be the causer of this under-frequency event as per the Code.

The information you provide will be used by the system operator to form a recommendation of who the causer of the event is to the Electricity Authority. The Electricity Authority will make the final determination of causer.

If you require any further details, please let me know

Regards,

Scott Avery
Risk and Compliance Manager
System Operations

Keeping the energy flowing Transpower New Zealand Ltd The National Grid

1.3 SYSTEM OPERATOR REQUEST FROM INFORMATION – GRID OWNER

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TRANSPOWER

Waikoukou
22 Boulcott Street
PO Box 1021
Wellington 6140
New Zealand
P 64 4 495 7000
F 64 4 495 7100
www.transpower.co.nz

Scott Avery
Tel: (04) 590 6144
Fax: (04) 495 7154

13 February 2020

Kent Murrell
Compliance Manager
Grid Owner
Transpower
Wellington

Dear Kent,

4 February 2020 North Island Under-Frequency Event

At 23:33 on 4 February 2020, an under-frequency event occurred in the North Island. We are investigating the event and require information relating to several aspects of the event.

- We have identified that just prior to the event that:
  - The Pakuranga_Whakamaru_1 (PAK_WKM_1) circuit was removed from service at 23:31, and
  - the North Makaraewa T1 (NMA_T1) transformer also tripped at the same time as Huntly Unit 4.

  Could you provide information regarding these events and if you believe any of these may have played a part in the reduction of energy causing the under-frequency event on 4 February 2020.

- Could you also please consider and indicate whether or not you could be the causer of this under-frequency event as per the Code.

The information you provide will be used by the system operator to form a recommendation of who the causer of the event is to the Electricity Authority. The Electricity Authority will make the final determination of causer.

If you require any further details, please let me know

Regards,

Scott Avery
Risk and Compliance Manager
System Operations

1.4 GENESIS ENERGY RESPONSE

Genesis Energy Limited
The Genesis Energy Building
94 Bryce Street
Private Bag 3131
Hamilton 3204
New Zealand

T. 07 982 7909

28 February 2020

Scott Avery
Audit and Compliance Manager
Transpower New Zealand Limited
P O Box 1021
WELLINGTON 6140

By email: Scott.Avery@transpower.co.nz

Dear Scott,

RE: 04 February 2020 North Island Under-Frequency Event

I refer your letter dated 13 February 2020 requesting information from Genesis Energy to help identify the causer of the 04 February 2020 North Island under-frequency event.

With respect to HLY Unit 4 being 78MW off dispatch at 21:11:
At 21:00 Unit 4 was dispatched from 230MW to 123MW, a large step change of 107MW. Dispatch changes should be limited to five times the ramp rate/min for Rankine units. This did not occur and was not identified by either System Operator or Genesis staff at the time. The unit reduced load to its dispatched value at the appropriate ramp rate.

Regarding the bona-fide claim at 23:31:
This was separate to the 21:11 issue. The Rankine unit's start-up standby feed pump (SSFP) needs to be run for 30 minutes once every 21 days. If this does not occur via normal start-up activities, it is run with the unit either on or off load and has been common practice for several years. In this instance, Unit 4 was running and the runup was undertaken with the unit on load.

At 23:04 the SSFP was started. Over the course of the SSFP runup a sequence deviation occurred that impacted the main boiler feed pump (MBFP) governor valves and the boiler drum level decayed. A bona-fide event was declared at 23:31. Continued attempts to resolve the low drum level were unsuccessful and the unit tripped at 23:33

The MBFP problem was initiated by the SSFP sequence and the procedure for the runup has since changed to prevent a reoccurrence.

Causer:
Genesis Energy considers it (Huntly Unit 4) was the causer of the 04 February North Island under-frequency event and the data previously provided to Market Operations supports this.

Loss of Injection Figure:
Genesis believes the loss of injection figure is 178.5MW and the data previously provided to Market Operations supports this.

Yours faithfully
GENESIS ENERGY LIMITED

Steve Leppien
Regulatory and Quality Assurance Manager

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1.5 GRID OWNER RESPONSE

TRANSPOWER

Keeping the energy flowing

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22 Boulcott Street
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Wellington 6140
New Zealand
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www.transpower.co.nz

05 March 2020

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Scott Avery
Risk and Compliance Manager
System Operations
Transpower
Wellington

Dear Scott

I refer to your letter of 13 February 2020 and the questions you raised relating to the under-frequency event that occurred when Huntly Unit 4 tripped on 4 February 2020.

Using data retrieved from the SysAct records the sequence of events was

23:30:18	PAK-WKM-1 was removed from service for voltage control
23:33:36.313	HLY Unit 4 tripped
23:33:36.672	The restricted earth fault element of NMA transformer T1 differential protection operated and tripped T1

PAK-WKM-1 and PAK-WKM-2 are alternatively taken out of service on a regular (daily) basis at the request of the system operator in order to control voltage in the upper North Island. I have been unable to find any other circumstances where the removal of these circuits has caused a generator, particularly HLY Unit 4 to trip.

Over the last year or so we have experienced a small number of situations where a restricted earth fault element on transformer differential protection has tripped following a remote tripping on the grid. One instance was when INV T1 tripped following a 220kV fault in the upper South Island. Although there was no conclusive evidence to suggest that the two trippings were related, it is possible that due to light loading on the system at the time (early morning) that the two trippings may have been related.

This issue with the restricted earth fault element has been confined to one model of relay and to date we have been unable to clearly identify why it is happening. The issue has been remedied in the short-term by de-sensitising the relay without affecting the overall protection of the transformers. We are currently in discussion with the manufacturer of this model of relay to try and understand why this is happening.

Although the removal of PAK-WKM circuit 1 and the tripping of NMA T1 occurred almost concurrently with HLY T1 tripping, there is nothing to suggest that the tripping of HLY Unit 4 was caused by these grid events. According to the SysAct data:

- PAK-WKM circuit 1 was removed from service 3 seconds before HLY unit 4 tripped.
- Both PAK-WKM circuits have been removed from service at around the same time every day for several years now without any issue.

- NMA T1 tripped about 250 milliseconds after HLY Unit 5 tripped. It is difficult to understand how a tripping of a generator in Waikato could possibly cause a relay in the bottom of the South Island to trip, but this is "similar" to the event when INV T1 tripped for a 220kV fault in the upper South Island.

Considering the above information, I do not believe the grid owner is the causer of the under-frequency event that occurred on 4 February 2020 when HLY Unit 4 tripped.

Yours sincerely

Kent Murrell
Grid Compliance Manager

1.6 CLARIFICATION OF MW LOST CALCULATION – EMAIL EXCHANGE

RE: Value of MW Lost for UFE 4 Feb 2020

Steve Leppien <Steve.Leppien@genesisenergy.co.nz>
To Scott Avery

Reply | Reply All | Forward | ...

Wed 11/03/2020 3:03 PM

You replied to this message on 11/03/2020 3:13 PM.

Action Items | + Get more add-ins

Cyber Security Warning – External E-Mail CAUTION: Please ensure you take **EXTRA CARE** when opening any links or attachments.

Hi Scott

I acknowledge your email and the methodology used as per 4.2 below.

Thank you for the clarification. On this basis I agree with the figure of 182.5MW.

Regards

Steve

From: Scott Avery <Scott.Avery@transpower.co.nz>
Sent: 11 March 2020 14:57
To: Steve Leppien <Steve.Leppien@genesisenergy.co.nz>
Subject: Value of MW Lost for UFE 4 Feb 2020

Hi Steve,

I am completing my report for the EA on the UFE event of 4 February 2020. In your letter you believe the value of MW lost to be 178.5MW. We have used the below methodology to determine the MW lost. In our assessment we determine the value to be 182.5MW. I will be submitting the value as 182.5MW.

We believe that you have used the last value immediately prior to the drop of generation. In our methodology we use the value 60 Seconds prior to the frequency reaching 49.25Hz. This method allows us to manage different types of disconnections, for example a slow but significant ramp that is not instantaneous.

The methodology used for determining amount of MW lost is outlined in our published document PR-RR-017, as shown in the clip below.

4.2 Amount of MW lost methodology

Purpose For the purposes of the **event charge** calculation pursuant to clause 8.64 of the Code, the **system operator** will use the following methodology to calculate the electric power (expressed in **MW**) lost in an **under-frequency event:**

Process The amount of **MW** lost will be assessed using the behaviour of the relevant site 60 seconds before the frequency fell below 49.25 Hz (as determined by **system operator** frequency logging).

	Methodology
1	The pre-event **MW** will be evaluated at the level of injection at the relevant site 60 seconds prior to the frequency reaching 49.25Hz.
2	The post-event **MW** will be evaluated as the lowest generation **MW** recorded before the grid frequency dropped below 49.25Hz.
3	The amount of **MW** lost will be assessed by subtracting the post-event **MW** from the pre-event **MW**.
4	If the **system operator** reasonably considers the data available to it is not sufficiently accurate, the **system operator** can calculate the amount of **MW** lost using the lowest value produced through simulation.

The relevant data points are outlined in the table below.

Relevancy	Time	HLY4 (MW)	Frequency (Hz)
Level of injection 60 s prior to frequency reaching 49.25 Hz	04-Feb-20 23:32:37	182.4941406	49.9950676
Last generation recorded before frequency fell to below 49.25 Hz	04-Feb-20 23:33:37	0	49.33127594
Frequency below 49.25 Hz	04-Feb-20 23:33:38	0	49.23267365

Consequently,
pre-event MW = 182.5 MW
post event MW = 0 MW
MW lost = 182.5 MW.

For the purposes of determining the potential charge this would equate to

$1250 x (182.5-60) = $153,125

Thanks

Scott

SCOTT AVERY
Audit and Compliance Manager

Appendix 2: CHARTS

Weather forecast for New Zealand 4 February 2020

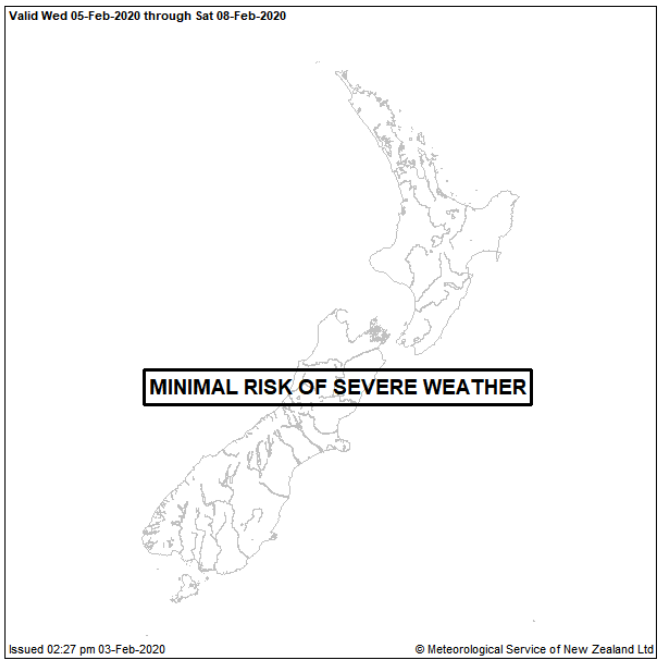
Severe Weather Outlook for New Zealand

Issued 02:27pm Monday 3 Feb 2020
Valid from Wednesday 5 Feb 2020 to Saturday 8 Feb 2020

An active front currently affecting the South Island is bringing significant heavy rain to west and south of the South Island, and strong northwesterlies in the east of the South Island and the lower North Island. Severe weather warnings and Watches are in force until late Tuesday. The front is expected to move north across the North Island late Tuesday.

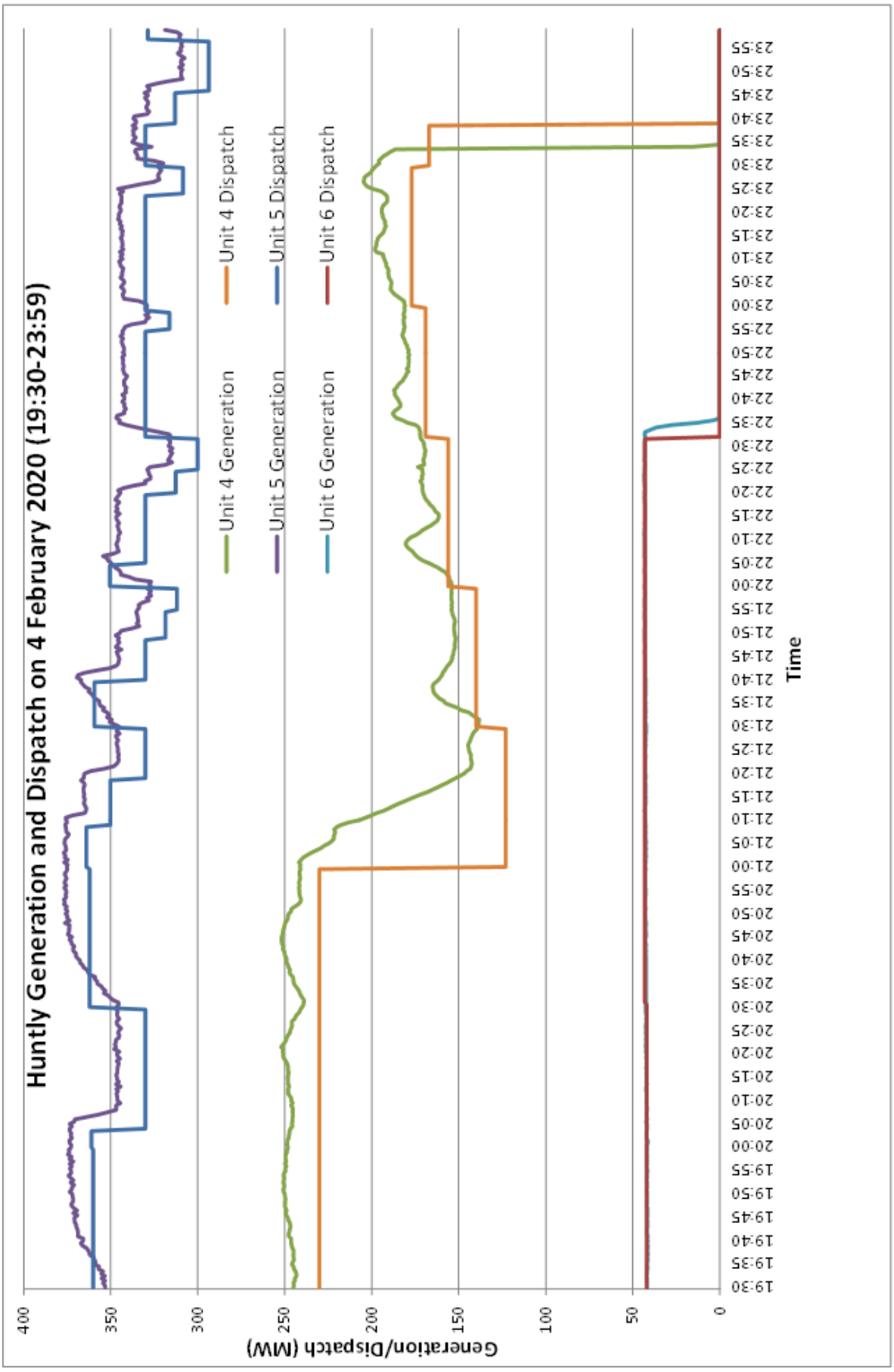
A ridge of high pressure is forecast to build across much of New Zealand on Wednesday and remain slow moving through to Friday. Another cold front should move over the South Island from the southwest on Saturday.

There is minimal risk of further severe weather from Wednesday to Saturday after the current significant weather event.



Low confidence: a 20% likelihood (or 1 chance in 5) that the event will actually happen.
Moderate confidence: a 40% likelihood (or 2 chances in 5) that the event will actually happen.
High confidence: a 60% likelihood (or 3 chances in 5) that the event will actually happen

Huntly Generation 4 February 2020



System Frequency Trace 4 February 2020