

# System Performance Report

## To the Electricity Commission

### January 2010

#### *Purpose*

This System Performance Report summarises power system performance each month. The detailed reporting of system events is intended to provide an understanding of the nature of system events that occur in the normal course of the real time co-ordination of security and to identify emerging issues in system operation.



SYSTEM OPERATOR

*Keeping the energy flowing*

TRANSPOWER



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## 1. SUMMARY OF SYSTEM PERFORMANCE

This system performance report covers the month of January 2010.

### Principal Performance Obligations

The System Operator met the Principal Performance Obligations during the reporting period.

### Operational Management

On 25 January Hamilton-Whakamaru 1 and Ohinewai-Whakamaru 1 circuits tripped as a result of fire under the circuits. These caused overloading and subsequent trippings of Arapuni-Hamilton 1 and 2 as well as Arapuni-Bombay 1 circuits. Considerable load management was required in Zone 1 (Northland and Auckland) until circuits were returned to service.

### System Events

A tripping of Balclutha-Berwick-Halfway Bush 1 circuit on 21 January resulted in loss of connection to Berwick station (5 MW).

A bus fault at Maraetai on 21 January causing trippings of Maraetai-Whakamaru 1, Maeratai-Whakamaru 2 and Maraetai-Waipapa 1 circuits as well as Maraetai and Waipapa station (total loss approximately 200 MW).

Other noteworthy events occurring during the reporting period include:

- Tripping of Kinleith unit G1 on 6 January;
- Tripping of Oamaru-Blackpoint-Waitaki 1 circuit on 14 January resulted in loss of connection to Blackpoint (approximately 8 MW);
- Tripping of Kawerau geothermal station on 17 January;
- Tripping of Poihipi Road unit G1 on 19 January;
- Tripping of Ohaaki unit G6 on 20 January;
- Tripping of Te Kaha-Waiotahi 1 circuit on 21 January resulted in loss of connection to Te Kaha (0.9 MW);
- Tripping of Ohaaki units G1 and G2 on 22 January;
- Trippings of Inangahua-Kikiwa 1 and 2 circuits on 23 January resulted in loss of connection to Murchison (1.6 MW);
- Tripping of Wairakei units G7 and G14 on 24 January;
- Tripping of Wheao station on 26 January;
- Trippings of Hamilton-Waihou 1 and 2 circuits on 26 January resulted in loss of connection to Waihou (32 MW), Waikino (21 MW) and Kopu (26 MW);
- Tripping of Wairakei units G1, G7 and G14 on 27 January;
- Fault in Te Awamutu 11 kV network on 27 January resulted in loss of connection to Te Awamutu (11 MW);
- Trippings of Islington-Kikiwa 2 and 3 circuits, Waipara T12 and T13 interconnecting transformers as well as Culverden T22 and T23 supply transformers on 28 January resulted in loss of connection to Culverden (11 MW) and Kaikoura (5 MW); and
- Tripping of Karapiro-Te Awamutu 1 circuit on 31 January resulted in loss of connection to Te Awamutu (18 MW).



## 2 PRINCIPAL PERFORMANCE OBLIGATIONS

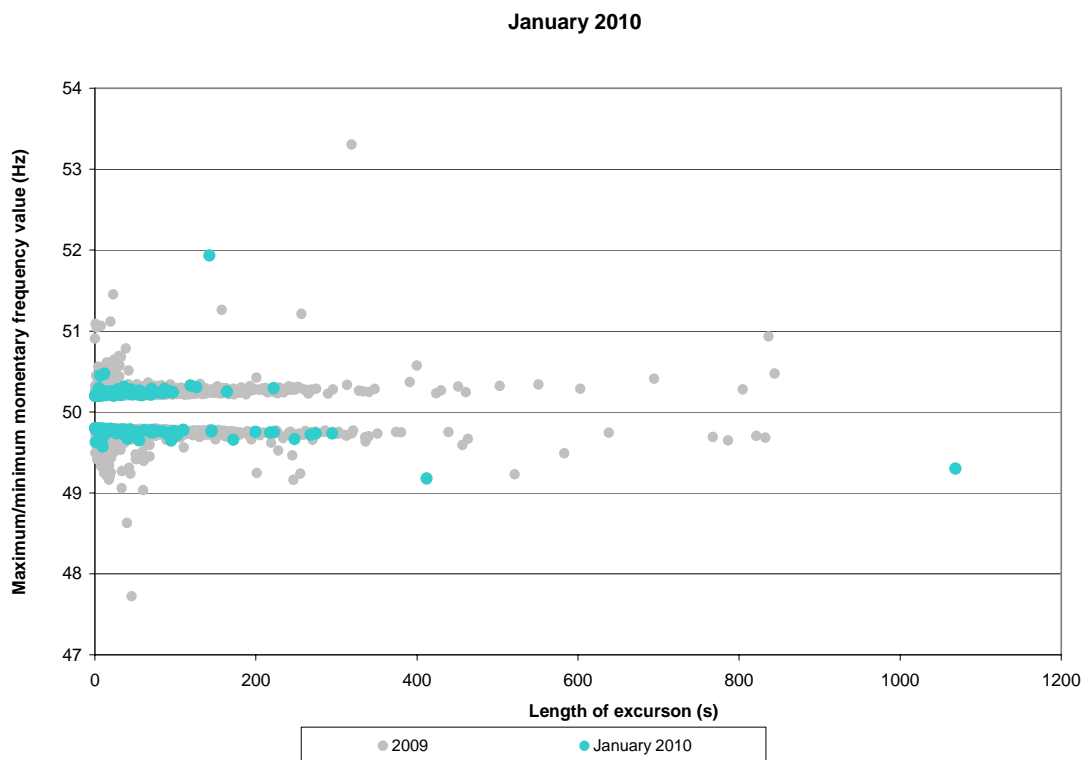
### 2.1 AVOID CASCADE FAILURE

No instances of cascade failure resulting in loss of demand arising from frequency or voltage balances or supply and demand imbalances occurred during the reporting period.

### 2.2 FREQUENCY

#### Maintain frequency in normal band and recover quickly from a fluctuation

The chart below shows the number, maximum or minimum frequency reached and length of frequency excursions outside the normal band (49.8 to 50.2 Hz) during the reporting period. The majority of excursions are within 0.4 Hz of the normal band and frequency typically returns to within the normal band within 2 minutes.



#### Manage Frequency and limit rate of occurrences during momentary fluctuations

The table below shows the total number of momentary fluctuations outside the frequency normal band, recorded in both Islands, over the last 12 months. The 12 month cumulative totals, grouped by frequency band, are compared to the frequency performance objective (PPO).

Frequency Band	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Annual rate	PPO target
55.00 >= Freq > 52.00			1										1	
52.00 >= Freq > 51.25			1						1			1	3	7
51.25 >= Freq > 50.50	1		2	2		2	2	6	4	1	1		21	50
50.50 >= Freq > 50.20	152	241	380	231	267	416	359	292	228	85	148	140	2939	
50.20 >= Freq > 49.80														
49.80 >= Freq > 49.50	129	114	221	181	204	336	257	154	152	98	134	109	2089	
49.50 >= Freq > 48.75	5	4	9	2	1	3	1	3	2		2	2	34	60
48.75 >= Freq > 48.00			1										1	6
48.00 >= Freq > 47.00							1						1	0.2
47.00 >= Freq > 45.00													0	0.2

### Manage time error and eliminate time error once per day

The time error performance criteria are:

- Time error must be managed within +/- 5 seconds.
- Time error must be eliminated at least once every day.

Time Error Compliance Table		Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10
Time Error Management	NI	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
	SI	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Error Elimination	NI	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	SI	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

## 3 OPERATIONAL MANAGEMENT

### 3.1 SECURITY NOTICES

The following table shows the number of Warning Notices, Grid Emergency Notices, Customer Advice Notices and Demand Allocation Notices issued over the last 12 months.

Notices issued	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10
Demand Allocation Notice												
Grid Emergency Notice	1	4	8	4	4	8		8	6		1	4
Warning Notice			4	3	9	9		5	3	1		
Customer Advice Notice		3	19	23	4	11	6	7	41	16	11	18



### 3.2 GRID EMERGENCIES

The following table shows grid emergencies declared by the System Operator in the reporting period.

Date	Time	Summary Details	Island
21 January 2010	11:20	A Grid Emergency was declared for load management and a grid reconfiguration at Bombay to manage a contingency of either Ohinewai-Otahuhu 1 or 2 circuits which would cause offload time violations on Bombay-Hamilton 1 and 2 circuits.	North
25 January 2010	15:12	A Grid Emergency was declared for load management in Zone 1. Trippings of Hamilton-Whakamaru 1 and Ohinewai-Whakamaru 1 circuits as a result of fire under the circuits caused overloading and subsequent trippings of Arapuni-Hamilton 1 and 2 as well as Arapuni-Bombay 1 circuits.	North
28 January 2010	15:46	A Grid Emergency was declared at Penrose and Pakuranga for transfer of load from Penrose to Mount Roskill due to an unplanned outage of Otahuhu T4 interconnecting transformer. For the loss of either Bombay-Hamilton 1 or 2, or Otahuhu-Penrose 5 or 6 circuits, Otahuhu T2 interconnecting transformer would exceed its advised rating.	North

A summary of grid emergencies that have occurred in the last 12 months is shown in the following table.

Island	Region	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Total
North Island	Northland													0
	Auckland	1								1			2	4
	Zone 1												1	1
	Waikato									1		1		2
	Bay of Plenty		1			1								2
	Hawkes Bay													0
	Taranaki													0
	Bunynthorpe		1	1										2
	Wellington			1		2	8		5					16
	North Island (all)				4	1			3	4				12
South Island & HVDC	Nelson Marlborough		1	3										4
	West Coast			1										1
	Christchurch													0
	Canterbury		1											1
	Zone 3													0
	Otago													0
	Southland			2										2
	South Island (all)													0
	HVDC													0

### 3.3 CUSTOMER ADVICE NOTICES (CANs)

Eighteen CANs (Customer Advice Notices) were issued in the reporting period:

- four advised of changes in HVDC Pole 1 offer;
- three advised of changes to permanent constraints;



- three related to changes being made to Reserve Management Tool which became effective on 13 January 2010;
- one advised participants of the convention of an Industry Advisory Group by the Grid Owner to consult on matters relating to the commission of HVDC Pole 3 and sought nominations from participants;
- one advised of the confirmation of an under frequency event on 17 January 2010;
- one advised the disabling of the Arapuni runback scheme from 21:00 on 27 January 2010 until further notice;
- four related to an unplanned outage of the Market System; and
- one related to the delay in the provision of final trading period information.

### 3.4 STANDBY RESIDUAL CHECK (SRC) NOTICES

Eighty four SRC notices were issued during the reporting period. SRC notices reported here are those issued based on the SDS (System Operator's own load forecasting tool). Other SRC notices were issued based on the PDS (based on participants demand bids), these notices are not summarised below.

The SRC notices applied to trading periods on 5<sup>th</sup>, 6<sup>th</sup>, 9<sup>th</sup>, 18<sup>th</sup>-23<sup>rd</sup> and 25<sup>th</sup>-30<sup>th</sup> of January 2010. The SRC notices identified energy and capacity shortfalls in the North Island. A Capacity Shortfall indicates that there would be insufficient generation and reserve offers remaining after the tripping of the largest risk (Generator or HVDC Pole) to restore reserves for a subsequent event within 30 minutes. An Energy Shortfall indicates that there would be insufficient generation remaining after the tripping of the largest risk (Generator or HVDC Pole) to release reserves after the event and that the unplanned disconnection of demand would likely be required following the loss of the largest risk.

### 3.5 VOLTAGE MANAGEMENT

Grid voltages did not exceed the EGR voltage ranges during the reporting period. There were some occasions when post contingency voltages could have exceeded the grid voltage range (had the contingency occurred) but these were managed through re-dispatch of generation and reactive devices.

Generation re-dispatch at Cobb and Lake Coleridge was required to manage post-contingency steady state voltages.

No contracted voltage support ancillary services were called upon during the reporting period.

### 3.6 OUTAGE MANAGEMENT

The following table shows the number of outages over the last 12 months where operational measures (generation agreements, load management agreements or grid re-configurations) were required to allow the outage to proceed. Load agreements generally require the distributor to manage load at one or more grid exit points. Generation agreements are required to ensure that sufficient regional generation is available to provide energy or reactive support during the outage to maintain security standards. Grid re-configurations typically involve splitting the network during the outage to manage post contingency power flows. Security of supply is sometimes reduced by grid re-configuration.



Island	Region	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Total
North Island	Northland	6	8	11	10	10	1	4	4	8	24	4	1	91
	Auckland	7	10	3	5	7	5	3	15	7	13	8	1	84
	Waikato	5	3	3	5	7	2	2	3	6	7	5	2	50
	Bay of Plenty	1	1	5	3	7	5	3	10	4	5	2	2	48
	Hawkes Bay	3	1	5	2	3	5		1	2	3	1	3	29
	Taranaki	1	1	2	2	2	3			1	3	1	1	17
	Bunnythorpe	5	4	10	6	5	3			5	3	1	3	45
	Wellington	9	3	2	12	3	2	1	7	4	7	6	2	58
Total		37	31	41	45	44	26	13	40	37	65	28	15	422
South Island	Nelson Marlborough	6	6	4	1	0	2	3	10	5	6	2	1	46
	West Coast	2	6	2	7	0	3	4	2	2	4			32
	Christchurch	4	1	5	3	0	1	1	4	4	3	4	2	32
	Canterbury		1	4	2	1	3	1		3	3			18
	Otago	7	3	2	3	1		3	1	5	2		3	30
	Southland	5	7	5	4	2		3		10	4	2	2	44
Total		24	24	22	20	4	9	15	17	29	22	8	8	202

### 3.7 CONSTRAINTS

#### SUMMARY: Security constraints binding during the month

The following table shows the constraints binding during the reporting period.

Island	Region	Constraint Name	Description
North Island	Bunnythorpe	BPE_MTN_WGN_2_S_O_1B	The effect of this constraint is to manage flows through Hawera-Stratford 1 for a contingency of Bunnythorpe-Wanganui 1 when Bunnythorpe-Wanganui 2 and Marton_T2 are out of service.
	Hamilton	ARI_HAM_1_and_2_ARI_RUNBACK_DISABLED_S_P_1	The effect of this constraint is to manage flows through Arapuni-Hamilton 1 and 2 for a contingency of Arapuni-Hamilton 2 or 1 during high ARI generation. Arapuni Runback Scheme disabled.
		ARI_HAM_1_and_2_ARI_RUNBACK_ENABLED_S_P_1	The effect of this constraint is to manage flows through Arapuni-Hamilton 1 and 2 for a contingency of Arapuni-Hamilton 2 or 1 during high ARI generation. Arapuni Runback Scheme enabled.
		ARI_BOB_1_ARI_RUNBACK_ENABLED_S_O_1	The effect of this constraint is to manage flows through Arapuni - Hamilton 1 for a contingency of Arapuni - Hamilton 2 when Arapuni - Bombay 1 is out of service and the Arapuni Runback Scheme is enabled.
		OHW_WKM_1_S_O_1A	The effect of this constraint is to manage flows through Kinleith Tarukenga 1 for a contingency of Hamilton Whakamaru 1 during high Zone 1 load and low Zone 1 generation when Ohinewai Whakamaru 1 is out of service
Hawkes Bay	FHL_RDF_1&2_S_P_1_z	The effect of this constraint is to manage flows through Fernhill-Redclyffe 2 for a contingency of Fernhill-Redclyffe 1 during low Tuai generation and high Hawkes Bay load.	



Island	Region	Constraint Name	Description
South Island & HVDC	Christchurch	ISL_LIV_1_S_O_1	The effect of this constraint is to manage flows through the remaining in-service Aviemore-Benmore circuit for a contingency of either Aviemore-Benmore 1 or 2 when Islington-Livingstone 1 is out of service.
	Nelson	STK_UTK_1_S_P	The effect of this constraint is to manage flows through STK_UTK_1 for a contingency of COB_STK_2 during low COB generation.
	Otago	NSY_ROX_1_W_P_1_z	The effect of this constraint is to manage flows through Naseby-Roxburgh-1 for a contingency of Clyde-Twizel-1 or 2 during high Southland generation and with all circuits in service.
		NSY_ROX_1_S_P_z	The effect of this constraint is to manage flows through Naseby-Roxburgh-1 for a contingency of Clyde-Twizel-1 during high Southland generation when all circuits are in service.
	HVDC	DCNPole1Max	The purpose of this constraint is to limit the flow on HVDC Pole 1 to the Asset Owner's offered capability.
		DCNPole1Min	The purpose of this constraint is to limit the flow on HVDC Pole 1 to the Asset Owner's offered capability.
		BEN_HAYP1max	The purpose of this constraint is to limit the flow on HVDC from Benmore to Haywards to the Asset Owner offered capability for Pole 1.

Additional information on security constraints can be found on the following website address: <http://www.transpower.co.nz/?id=5979>. This information includes constraint equations and a brief summary of their purpose.



### Constraints binding during last 12 months

The following table shows the constraints binding during the reporting period for more than 4 trading periods and during the previous 12 months for more the 48 trading periods.

Island	Region	Constraint	Reporting period		Previous 12 months	
			Number of trading periods that constraint bound	Percentage of trading periods	Number of trading periods that constraint bound	Percentage of Trading periods
North Island	Bunnythorpe	BPE_MTN_WGN_2_S_O_1B	15	1.01%	0	0.00%
	Hamilton	ARI_BOB_1_ARI_RUNBACK_ENABLED_S_O_1	11	0.74%	0	0.00%
		ARI_HAM_1_and_2_ARI_RUNBACK_DISABLED_S_P_1	17	1.14%	0	0.00%
		ARI_HAM_1_and_2_ARI_RUNBACK_ENABLED_S_P_1	54	3.63%	0	0.00%
	Hawkes Bay	FHL_RDF_1&2_S_P_1_z	2	0.13%	52	0.30%
South Island & HVDC	Christchurch	ISL_LIV_1_S_O_1	4	0.27%	0	0.00%
	Nelson	STK_UTK_1_S_P	1	0.07%	145	0.83%
	Otago	NSY_ROX_1_S_P_z	199	13.37%	190	1.08%
		NSY_ROX_1_W_P_1_z	5	0.34%	86	0.49%
	HVDC	BEN_HAY1.1	0	0.00%	63	0.36%
		BEN_HAY2.1	0	0.00%	57	0.33%
		DCNPole1Max	701	47.11%	1359	7.76%
		DCNPole1Min	732	49.19%	1297	7.40%
		BEN_HAYP1max	1	0.07%	541	3.09%



## 4 SYSTEM EVENTS

### 4.1 SIGNIFICANT SYSTEM EVENTS

The following table shows significant events (frequency excursions and connection point events) which occurred during the reporting period.

#### Significant frequency excursions

Date	Time	Summary Details	Island	Freq (Hz)
17 January 2010	10:16	HVDC runback operation causing momentary frequency fluctuations in both North and South Islands.	North South	49.18 50.41 51.94
21 January 2010	17:13	Maraetai-Waipapa, Maraetai-Whakamaru 1 and 2 circuits tripped causing momentary drop in frequency in the North Islands.	North	49.3
25 January 2010	14:45	Hamilton-Whakamaru 1 circuit tripped (preceded by the tripping of Ohinewai-Whakamaru 1 circuit earlier at 14:17) causing momentary drop in frequency in the North Island.	North	49.5

#### Connection point events

Date	Time	Summary Details	Generation/Load interrupted (MW)	Restoration time (minutes)
21 January 2010	04:47	Balclutha-Halfway Bush 1 tripped resulting in loss of connection at Berwick.	5	116
21 January 2010	17:13	Maraetai-Waipapa 1, Maraetai-Whakamaru 1 and 2 circuits tripped causing loss of connection at Waipapa and Maraetai	WPA 43.7 MTI 151	157 154



## 4.2 SYSTEM EVENTS DURING REPORTING PERIOD

System events that occurred during the reporting period are summarised below.

### Contingent events

Event	Number	Summary
Loss of single AC transmission circuit	51	<p>These related to trippings of</p> <ul style="list-style-type: none"> <li>▪ Opunake-Stratford 1</li> <li>▪ Otahuhu-Whakamaru 2 (Auto Reclose)</li> <li>▪ Livingstone-Naseby 1</li> <li>▪ Oamaru-Blackpoint-Waitaki 1</li> <li>▪ Rangipo-Tangiwai 1</li> <li>▪ Arapuni-Hangatiki-Ongarue 1</li> <li>▪ Huntly-Otahuhu 2 (x3)</li> <li>▪ Islington-Livingstone 1 (Auto Reclose) (x3)</li> <li>▪ Balclutha-Berwick-Halfway Bush 1</li> <li>▪ Taumarunui-Te Kowhai 1</li> <li>▪ Te Kaha-Waiotahi 1</li> <li>▪ Coleridge-Otira 2</li> <li>▪ Blenheim-Kikiwa 1</li> <li>▪ Redclyffe-Tuai 2 (Auto Reclose)</li> <li>▪ Fernhill-Tuai 1 (Auto Reclose) (x2)</li> <li>▪ Inangahua-Kikiwa 1 &amp; 2 (Auto Reclose)</li> <li>▪ Owhata-Whakamaru 1</li> <li>▪ Hamilton-Whakamaru 1 (Auto Reclose)</li> <li>▪ Arapuni-Bombay 1</li> <li>▪ Redclyffe-Wairakei 1 (Auto Reclose) (x2)</li> <li>▪ Bunnythorpe-Tokaanu 1 (Auto Reclose)</li> <li>▪ Whirinaki-Wairakei 1 (Auto Reclose) (x2)</li> <li>▪ Huntly-Stratford 1 (Auto Reclose)</li> <li>▪ Stratford _Taumarunui 1</li> <li>▪ Taumarunui-Te Kowhai 1 (x4)</li> <li>▪ Arapuni-Hamilton 1</li> <li>▪ Arapuni-Pakuranga 1</li> <li>▪ Kinleith-Lichfield-Tarukenga 1 (Auto Reclose)</li> <li>▪ Atiamuri-Tarukenga 2 (Auto Reclose)</li> <li>▪ Kinleith-Lichfield-Tarukenga 1 (Auto Reclose)</li> <li>▪ Ohaaki-Wairakei 1</li> <li>▪ Owhata-Te Matai-Tarukenga 1 (Auto Reclose)</li> <li>▪ Edgecumbe-Tarukenga 1 &amp; 2 (Auto Reclose)</li> <li>▪ Rangipo-Wairakei 1</li> <li>▪ Ohaaki-Wairakei 1</li> <li>▪ Otahuhu-Mt Roskill 2</li> <li>▪ Huntly-Stratford 1 (Auto Reclose) (x2)</li> <li>▪ Karapiro-Te Awamutu 1</li> </ul>
Loss of HVDC pole	4	<p>These related to trippings of</p> <ul style="list-style-type: none"> <li>▪ HVDC Valve Group VG1 (x3)</li> <li>▪ HVDC runback operation</li> </ul>
Loss of single generation units	8	<p>These related to trippings of</p> <ul style="list-style-type: none"> <li>▪ Kinleith G1</li> <li>▪ Kawerau</li> <li>▪ Poihipi G1</li> <li>▪ Ohaaki G1, G2 &amp; G6</li> <li>▪ Wheao</li> <li>▪ Wairakei G1, G7, &amp; G14</li> </ul>
<b>Total during reporting period</b>	<b>63</b>	



### Extended contingent events

Event	Number	Summary
Loss of both HVDC poles	0	

### Other events

Event	Number	Summary
Loss of multiple AC transmission circuits	5	This event related to trippings of <ul style="list-style-type: none"> <li>▪ Halfway Bush-Roxburgh 1 &amp; 2 (Auto Reclose)</li> <li>▪ Arapuni-Hamilton 1 &amp; 2 (Auto Reclose)</li> <li>▪ Hamilton-Waihou1 &amp; 2 (Auto Reclose)</li> <li>▪ Huntly-Stratford 1 (Auto Reclose)</li> <li>▪ Islington-Kikiwa 2 &amp; 3</li> </ul>
Loss of bus bar section	2	This event related to trippings of <ul style="list-style-type: none"> <li>▪ Maraetai</li> <li>▪ Te Awamutu</li> </ul>
Loss of interconnecting transformer	1	This event related to trippings of <ul style="list-style-type: none"> <li>▪ Otahuhu T4</li> </ul>
Loss of grid reactive plant	5	This event related to trippings of <ul style="list-style-type: none"> <li>▪ Stoke C31 (x2), C32, C34</li> <li>▪ Islington C15</li> </ul>
Loss of supply transformer	3	These events related to trippings of <ul style="list-style-type: none"> <li>▪ Tangiwai T2</li> <li>▪ Motueka T6</li> <li>▪ Waihou T1</li> </ul>
Demand change	0	
Loss of multiple generation units	1	These events related to trippings of <ul style="list-style-type: none"> <li>▪ Arapuni-Hamilton 1 &amp; 2</li> </ul>
HVDC Start/ Stop	0	
<b>Total during reporting period</b>	<b>17</b>	

### Other disturbances

Event	Number	Summary
Feeder trippings	79	Various locations
Misc.	0	
<b>Total during reporting period</b>	<b>83</b>	



### 4.3 SYSTEM EVENTS – TREND

	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Total	Average Events per month
Contingent Event – transmission	19	24	23	42	19	16	24	16	22	4	12	50	272	22.7
Contingent Event – generation	7	7	8	15	8	11	9	11	14	13	15	8	126	10.5
Contingent Event - HVDC	0	0	1	0	0	0	1	0	15	2	1	4	24	2.0
Extended Contingent Event														
Other Event – AC transmission	0	1	2	5	2	2	0	1	1	0	1	5	20	1.7
Other Event – Busbar	0	3	2	2	1	0	1	1	0	2	1	2	15	1.3
Other Event – Demand	0	0	4	1	1	5	2	5	4	4	1	0	27	2.3
Other Event – Generation	1	4	0	0	0	0	0	2	0	1		1	9	0.8
Other Event – Interconnecting transformer	0	0	0	0	0	0	0	1	0	0	1	1	3	0.3
Other Event – Reactive plant	6	2	9	3	3	0	1	6	10	2	8	5	55	4.6
Other Event – Supply transformer	8	7	3	3	3	6	4	3	3	4	4	2	51	4.3

