

# System Performance Report

## To the Electricity Commission

### February 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 February 2010.

### Principal Performance Obligations

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

### Operational Management

On 18 February a Grid Emergency was declared in the North Island following unplanned outages of HVDC Poles 1 and 2. The circuits were taken out as a precautionary measure due to a fire under the HVDC overhead transmission line in the top of the South Island. Despite the increased generation offered, North Island load had to be reduced by 5%. No reserves were dispatched in North Island during this period.

### System Events

Significant Events:

- On 1 February a tripping of Dobson T12 interconnecting transformer as well as T1 and T2 supply transformers while Lake Coleridge-Otira 2 and Arthurs Pass-Otira 1 circuits were removed from service for planned outages caused loss of connection at Dobson, Greymouth, Kumara, Hokitika and Otira (approximately 34 MW).
- A fault at Ohau B 220 kV bus on 4 February caused loss of connection at Ohau B (30 MW).
- A tripping of Kaikohe-Kaitaia 1 circuit on 23 February resulted in loss of connection to Kaitaia (15 MW).

Other noteworthy events occurring during the reporting period include:

- Tripping of Kinleith unit G1 on 3 February;
- A fault at Carrington Street 33 kV bus on 9 February resulted in loss of connection to Carrington Street (18 MW);
- Trippings of Southdown unit G105 on 15 and 19 February;
- Trippings of Nga Awa Purua unit G1 on 16, 18 and 25 February;
- Trippings of Te Kaha-Waiotahi 1 circuit twice on 19 February resulted in loss of connection to Te Kaha (0.8 MW);
- A fault at Stoke 33 kV bus on 21 February resulted in partial loss of connection to Stoke (24 MW);
- Tripping of Ohaaki unit G4 on 25 February;
- Tripping of Te Apiti-Woodville 1 circuit on 25 February resulted in loss of connection to Te Apiti wind farm (7 MW).
- Tripping of Tiwai potline on 22 February.



## 2. PRINCIPAL PERFORMANCE OBLIGATIONS

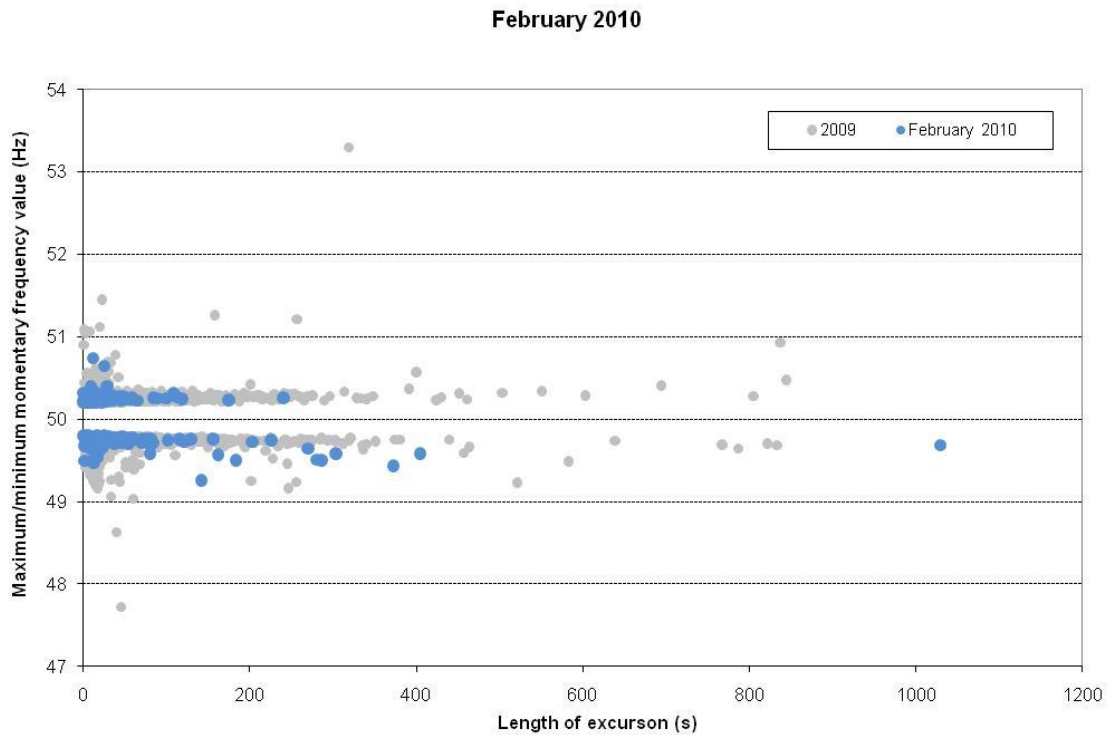
### 2.1 AVOID CASCADE FAILURE

No instances of cascade failure occurred during the reporting period.

### 2.2 FREQUENCY

Maintain frequency in normal band and recover quickly from a fluctuation

The chart below shows the maximum or minimum frequency reached and length of each frequency excursion 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	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-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		2	2		2	2	6	4	1	1		2	22	50
50.50 >= Freq > 50.20	241	380	231	267	416	359	292	228	85	148	140	279	3066	
50.20 >= Freq > 49.80														
49.80 >= Freq > 49.50	114	221	181	204	336	257	154	152	98	134	109	278	2238	
49.50 >= Freq > 48.75	4	9	2	1	3	1	3	2		2	2	5	34	60
48.75 >= Freq > 48.00		1											1	6
48.00 >= Freq > 47.00						1					1		2	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		Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10
Time Error Management	NI	Yes	Yes	Yes	Yes	Yes	No	Yes	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	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10
Demand Allocation Notice												
Grid Emergency Notice	4	8	4	4	8		8	6		1	4	3
Warning Notice		4	3	9	9		5	3	1			
Customer Advice Notice	3	19	23	4	11	6	7	41	16	11	18	31

#### 3.2 GRID EMERGENCIES

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

Date	Time	Summary Details	Island
1 February 2010	12:17	A Grid Emergency was declared for load restoration in West Coast following unplanned outages of Dobson T12 interconnecting transformer as well as T1 and T2 supply transformers. Lake Coleridge-Otira 2 and Arthurs Pass-Otira 1 circuits were removed from service for planned outages at the time, causing loss of load at Dobson, Greymouth, Kumara, Hokitika and Otira.	South
16 February 2010	08:49	A Grid Emergency was declared for grid reconfiguration and load management at Bombay following an unplanned outage of Arapuni-Bombay 1 circuit.	North
18 February 2010	11:49	A Grid Emergency was declared requesting for increase in energy and transmission offers in the North Island following unplanned outages of HVDC Poles 1 and 2. In addition to increased generation, North Island load had to be reduced by 5%. No reserves were dispatched in North Island during this period.	North



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

Island	Region	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Total
North Island	Northland													0
	Auckland								1			2	1	4
	Zone 1											1		1
	Waikato								1		1			2
	Bay of Plenty	1			1									2
	Hawkes Bay													0
	Taranaki													0
	Bunnythorpe	1	1											2
	Wellington		1		2	8		5						16
	North Island (all)			4	1			3	4				1	13
South Island & HVDC	Nelson Marlborough	1	3											4
	West Coast		1										1	2
	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)

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

Three related to the delay in the provision of final trading period information;

Four related to outages of the Market System;

One advised of application of new shoulder rating permanent constraints from 15 March 2010;

Five related to the commissioning and testing of Nga Awa Purua geothermal station;

Six related to the failure of publication of market schedules to COMIT;

One advised of the unplanned outages of HVDC Poles 1 and 2 due to a fire under the overhead line;

One advised of the increase in the number of allowable HVDC Pole 1 starts and operating hours for the period ending 31 August 2010;

Two advised of planned changes to the Market Systems;



Three related to reclassification of the loss of both Roxburgh-Three Mile Hill 1 and 2 circuits and North Makarewa-Three Mile Hill 1 and 2 circuits as a single contingent event; and

Five advised on an unplanned outage of HVDC Pole 1.

### 3.4 STANDBY RESIDUAL CHECK (SRC) NOTICES

A total of 123 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 2<sup>nd</sup>-5<sup>th</sup>, 8<sup>th</sup>-12<sup>th</sup>, and 15<sup>th</sup>-25<sup>th</sup> of February 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 provide 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 (two) occasions that required the re-dispatch of generation to manage post contingency voltages:

- Generation re-dispatch at Cobb and Lake Coleridge was required to manage post-contingency steady state voltages.
- Transmission outages required the dispatch of generation at Cobb, Lake Coleridge and Kumara 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	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Total
North Island	Northland	8	11	10	10	1	4	4	8	24	4	1	21	106
	Auckland	10	3	5	7	5	3	15	7	13	8	1	2	79
	Waikato	3	3	5	7	2	2	3	6	7	5	2	10	55
	Bay of Plenty	1	5	3	7	5	3	10	4	5	2	2	11	58
	Hawkes Bay	1	5	2	3	5		1	2	3	1	3	6	32
	Taranaki	1	2	2	2	3			1	3	1	1	5	21
	Bunynthorpe	4	10	6	5	3			5	3	1	3	5	45
	Wellington	3	2	12	3	2	1	7	4	7	6	2	7	56
Total		31	41	45	44	26	13	40	37	65	28	15	67	452
South Island	Nelson Marlborough	6	4	1	0	2	3	10	5	6	2	1	5	45
	West Coast	6	2	7	0	3	4	2	2	4			2	32
	Christchurch	1	5	3	0	1	1	4	4	3	4	2	1	29
	Canterbury	1	4	2	1	3	1		3	3			2	20
	Otago	3	2	3	1		3	1	5	2		3		23
	Southland	7	5	4	2		3		10	4	2	2	6	45
Total		24	22	20	4	9	15	17	29	22	8	8	16	194

### 3.7 CONSTRAINTS

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

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

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.

Island	Region	Constraint Name	Description
North Island	Hamilton	KIN_TRK_1_S_P_2A	The effect of this constraint is to manage flows through Kinleith - Tarukenga 1 for a contingency of Kinleith - Tarukenga 2 during low generation at Auckland, Huntly and Arapuni with all circuits in service.
		KIN_TRK_1_S_P_1A	The effect of this constraint is to manage flows through Kinleith Tarukenga1 for a contingency of Hamilton-Whakamaru 1 when Auckland generation is low.
		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.
		HAM_KPO_S_P_1	The effect of this constraint is to manage flows through the Hamilton-Karapiro circuits for a contingency of either one of the Hamilton-Karapiro circuits.
		OHW_OTA_2_S_O_1A	The effect of this constraint is to manage flows through Bombay-Hamilton 1 & 2 for a contingency of Ohinewai-Otahuhu 1 during high Waikato and low Auckland generation when Ohinewai-Otahuhu 2 is out of service and with the Bombay intertrip scheme disabled
		ARI_HAM_1_and_2_10min_S_P_TEMP_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.



Island	Region	Constraint Name	Description
South Island & HVDC	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.
	Southland	HWB_T4_S_O_2_z	The effect of this constraint is to manage flows through Roxburgh interconnecting transformer T10 for a contingency of Edendale-Invercargill 1 during low Southland 110 kV generation when Halfway Bush interconnecting transformer T4 is out of service.
	West Coast	WEST_COAST_SPLIT_O_1	The effect of this constraint is to manage voltage stability on the West Coast during low West Coast generation and high West Coast load when one of the following is out of service: Greymouth-Kumara, Dobson-Greymouth, Atarau-Dobson or Atarau-Reefton-Inangah
	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.

### Constraints binding during last 12 months

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

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	Hamilton	KIN_TRK_1_S_P_1A	14	1.04%	12	0.07%
		ARI_HAM_1_and_2_ARI_RUN_BACK_DISABLED_S_P_1	31	2.31%	17	0.10%
		ARI_HAM_1_and_2_ARI_RUN_BACK_ENABLED_S_P_1	0	0.00%	54	0.31%
South Island & HVDC	Nelson	STK_UTK_1_S_P	8	0.60%	142	0.81%
	West Coast	WEST_COAST_SPLIT_O_1	18	1.34%	44	0.25%
	Otago	NSY_ROX_1_S_P_z	0	0.00%	389	2.22%
		NSY_ROX_1_W_P_1_z	0	0.00%	91	0.52%
	Southland	HWB_T4_S_O_2_z	12	0.89%	0	0.00%
	HVDC	BEN_HAY1.1	0	0.00%	63	0.36%
		BEN_HAY2.1	0	0.00%	57	0.33%
		DCNPole1Max	428	31.85%	2060	11.76%
		DCNPole1Min	452	33.63%	2029	11.58%
BEN_HAYP1max		0	0.00%	542	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)
16 February 2010	00:46	Nga Awa Purua generation tripped causing a momentary drop in frequency in the North Island.	North	49.5
18 February 2010	11:40	HVDC Pole 2 had an emergency shut down causing momentary fluctuations in frequency in both the North and South Islands.	North South	49.26 50.74
18 February 2010	12:53	Excessive load restoration following an earlier emergency shutdown of HVDC Pole 2 caused a momentary drop in frequency in the North Island.	North	49.44
22 February 2010	11:49	Tiwai potline tripped causing a momentary rise in frequency in the South Island.	South	50.64
25 February 2010	21:42	Nga Awa Purua generation tripped causing a momentary drop in frequency in the North Island.	North	49.47

#### Connection point events

Date	Time	Summary Details	Generation/L oad interrupted (MW)	Restoration time (minutes)
1 February 2010	12:06	Unplanned outages of Dobson T12 interconnecting transformer as well as T1 and T2 supply transformers while Lake Coleridge-Otira 2 and Arthurs Pass-Otira 1 circuits were removed from service for planned outages caused loss of load at Dobson, Greymouth, Kumara, Hokitika and Otira.	Approx 34 MW total	Between 16-51
4 February 2010	09:33	A fault in the Ohau B 220 kV bus caused loss of connection at Ohau B.	30	70
23 February 2010	12:51	Kaikohe-Kaitaia 1 tripped resulting in loss of connection at Kaitaia.	15	300



## 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	20	These related to trippings of : <ul style="list-style-type: none"> <li>▪ Naseby-Roxburgh 1 (Auto Reclose)</li> <li>▪ Islington-Papanui 3</li> <li>▪ Woodville-Dannevirke-Waipawa 1 (x2)</li> <li>▪ Hawera-Whareroa 1 and Hawera-Waverly 1</li> <li>▪ Islington-Livingstone 1 (Auto Reclose)</li> <li>▪ Edgecumbe-Kawerau 2 (Auto Reclose)</li> <li>▪ Arapuni-Bombay 1</li> <li>▪ Halfway Bush-Roxburgh 2 (Auto Reclose)</li> <li>▪ Studholme-Timaru 1</li> <li>▪ Kinleith-Lichfield-Tarukenga 1 (Auto Reclose)</li> <li>▪ Arapuni-Hamilton 2 (Auto Reclose)</li> <li>▪ Te Kaha-Waiotahi 1 (Auto Reclose) (x2)</li> <li>▪ Kinleith-Lichfield-Tarukenga 1</li> <li>▪ Greymouth-Kumara 1</li> <li>▪ Kaikohe-Kaitaia 1</li> <li>▪ Dobson-Greymouth 1 (x2)</li> <li>▪ Otahuhu-Whakamaru 2 (Auto Reclose)</li> </ul>
Loss of HVDC pole	7	These related to trippings of : <ul style="list-style-type: none"> <li>▪ HVDC Pole 1 (x6)</li> <li>▪ HVDC Pole 2</li> </ul>
Loss of single generation units	10	These related to trippings of : <ul style="list-style-type: none"> <li>▪ Kinleith G1</li> <li>▪ Southdown (x2)</li> <li>▪ Nga Awa Purua (x3)</li> <li>▪ Mangahao G3 (x2)</li> <li>▪ Whakamaru G4</li> <li>▪ Te Apiti</li> </ul>
<b>Total during reporting period</b>	<b>37</b>	

### Extended contingent events

Event	Number	Summary
Loss of both HVDC poles	0	

### Other events

Event	Number	Summary
Loss of multiple AC transmission circuits	0	
Loss of bus bar section	1	This event related to the tripping of <ul style="list-style-type: none"> <li>▪ Carrington Street 33 kV</li> </ul>
Loss of interconnecting transformer	1	This event related to the tripping of <ul style="list-style-type: none"> <li>▪ Dobson T12</li> </ul>



Event	Number	Summary
Loss of grid reactive plant	6	This event related to trippings of <ul style="list-style-type: none"> <li>▪ Hokitika (x2)</li> <li>▪ Kikiwa STC 2B</li> <li>▪ Haywards F4B (x2)</li> <li>▪ Islington SVC 9</li> </ul>
Loss of supply transformer	2	These events related to trippings of <ul style="list-style-type: none"> <li>▪ Tangiwai T2</li> <li>▪ Addington T6</li> </ul>
Demand change	0	
Loss of multiple generation units	0	
HVDC Start/ Stop	0	
<b>Total during reporting period</b>	<b>10</b>	

### Other disturbances

Event	Number	Summary
Feeder trippings	44	Various locations
Misc.	0	
<b>Total during reporting period</b>	<b>44</b>	

### 4.3 SYSTEM EVENTS – TREND

	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Total	Average Events per month
Contingent Event – transmission	24	23	42	19	16	24	16	22	4	12	51	20	273	22.8
Contingent Event – generation	7	8	15	8	11	9	11	14	13	15	8	10	129	10.8
Contingent Event - HVDC	0	1	0	0	0	1	0	15	2	1	4	7	31	2.6
Extended Contingent Event	0	0	0	0	0	0	0	0	0	0	0		0	0.0
Other Event – AC transmission	1	2	5	2	2	0	1	1	0	1	5	0	20	1.7
Other Event – Busbar	3	2	2	1	0	1	1	0	2	1	2	1	16	1.3
Other Event – Demand	0	4	1	1	5	2	5	4	4	1	0	0	27	2.3
Other Event – Generation	4	0	0	0	0	0	2	0	1		1	0	8	0.7
Other Event – Interconnecting transformer	0	0	0	0	0	0	1	0	0	1	1	1	4	0.3
Other Event – Reactive plant	2	9	3	3	0	1	6	10	2	8	5	6	55	4.6
Other Event – Supply transformer	7	3	3	3	6	4	3	3	4	4	3	2	45	3.8

