Paper GCRP
September 2011

Grid Code Review Panel

Annual Summary Report for Significant System Events (1 August 2010 to 31 July 2011)

By National Grid

1 Introduction

1.1 This report, for the period 1 August 2010 to 31 July 2011, fulfils the requirement to provide the annual summary of the Rate of Change of Frequency (RoCoF) information, as endorsed by GCRP 00/16 (September 2000). The notified RoCoF events for the period are reviewed, and consideration given to the need for continued reporting.

1.2 Generation / Demand trips which caused a RoCoF event and severe system disturbances are reported for the above period.

1.3 Attached is the record of notified RoCoF tripping incidents for the previous 12 month period.

2 Background

2.1 The present ROCOF reporting procedure has been in place since May 1998 and was agreed by Panel representatives.

2.2 The procedure follows National Grid's concern that embedded generation protected by Rate of Change of Frequency (RoCoF) protection could trip following a large generation loss. The effect of such RoCoF trips could aggravate the resulting frequency change following the loss and have an adverse effect on normal frequency recovery.

2.3 In order to increase the knowledge of the behaviour of this RoCoF protected plant and the risk it may present to the system:

National Grid agreed to notify DNOs when an incident occurred likely to lead to RoCoF operation.

Following notification, DNOs inform National Grid of any generation tripping.

2.4 The procedure was triggered for generation losses of 1000 MW or more, demand losses of 1000 MW or more.

2.5 Any major transmission system events that are likely to cause the potential loss of embedded generation, such as three phase faults, are also covered by this report.

3 Summary of notified events during the period of review

3.1 Participants have provided the necessary information to National Grid following notification, including nil returns.

3.2 Appendix 1 provides details of each notified incident where a generation / demand trip of at least 900 MW or more occurred which caused a RoCoF event, together with a summary of any reported embedded generation trips subsequently reported to National Grid.

3.3 During the period of review there was one event that met the agreed reporting criteria.

4 Summary of reports 1st May 1998 to 31st July 2011

4.1 A summary of incidents is included in Appendix 2. Between 1st May 1998 and 31st July 2011 there have been 52 incidents where 1000 MW or more of generation was lost. Of these, 14 resulted in the loss of embedded generation.

4.2 The most embedded generation lost as a result of large loss was 406.2 MW on the 27th May 2008. This event of 1582 MW loss due to the loss of two generators within 2 minutes of each other that caused a rate of change of frequency of 0.073 Hz/s.

4.3 Losses of embedded generation during normal system operation have occasionally been reported in the course of normal operational contact.

4.4 Rates of change of frequency observed for the period 1st August 2010 to 31st July 2011 was at 0.07 Hz/s

5 Conclusions from the period reported

5.1 This last twelve months have seen only one occasion which could have given rise to a RoCoF event.

5.2 The evidence from this year's review period generally supports the conclusion of last year, that ROCOF operation following large losses is not significant for the rates of change of frequency experienced during normal operations and represents little risk to the system.

5.3 Normal operational contact has revealed occasions when embedded generation has tripped. It is not clear if these are consistently reported. However had there been a more onerous event the effects would be seen on the National Grid system.

6 Recommendations

6.1 Members of the Grid Code Review Panel are invited to :-

i) Provide comments on the contents of this report.

ii) Note the summary of incidents of possible ROCOF (Appendix 1) was sent to all DNOs on 02nd September 2011.

iii) Discuss the benefits of continuing the reporting requirements based on the evidence presented above, giving due consideration to the future impact of increasing levels of renewable and embedded generation and any known or anticipated changes in technology used in these applications.

iv) Note that National Grid will continue to take interest in any ROCOF operation, which is notified, from time to time via normal operational liaison.

Appendix 1
Incidents of Possible Rocof Trippings during the Period 01/08/10-31/07/11

APPENDIX 1

INCIDENTS OF POSSIBLE RoCoF TRIPPINGS during the period 01/08/10-31/07/11

Notified incidents which were likely to lead to the tripping of embedded generation due to

A) the loss of 1000MW (or more) of Demand or Generation or

B) A significant System Event

NOTIFICATIONS RECEIVED FROM DNOs AND MW LOST WHERE APPROPRIATE																				
		UK Power Networks			CE Electric		SSE		SP Power Systems			WPD								
Date	Time (Local)	EPN	LPN	SPN	YEDL	NEDL	E&W	Scotland	E&W	SCO	UU	South West	South Wales	East Midlands	West Midlands	RoCoF (Hz/Sec)	Loss (-)/ Gain (+) (MW)	Freq	Start Freq	Ref
19/04/2011	08:41:00	None	None	None	None	None	None	None	None	None	None	None	None	None	None	0.0705	-1175	49.667	50.034	

Notes:-

1) RoCoF is calculated by taking the frequency at the time of disturbance, then two seconds later and dividing the difference by two

2) The sign convention denotes an increase in generation if positive and a decrease in generation if negative.

APPENDIX 2
SUMMARY OF PREVIOUS INCIDENTS

Inc Date	Inc Time	Size Loss	RoCoF	Generation Lost (MW)	Max Freq reached	LOSS
18-May-98	09:53:00			0	0	
19-May-98	09:05:00	635		0	49.694	Scots 635MW
27-May-98	11:28:00			0	49.76	
30-May-98	02:06:00			0	49.72	
20-Jun-98	14:26:00	1000		18	49.675	Bipole 1 1000MW
29-Jun-98	05:03:00	410		0	49.77	Scots 410MW
02-Jul-98	11:59:00	1100		0	49.69	Heysham 1 550MW followed by Heysham 2 550MW four minutes later
04-Jul-98	08:32:00	600		0	49.77	Hartlepool 2 600MW
29-Jul-98	15:27:00	550	0.0395	0	49.74	Heysham 1 550MW
31-Jul-98	16:27:00		0.0485	0	49.75	
07-Aug-98	18:06:00	645	0.0372	0	49.8	Drax 1 645 MW
17-Aug-98	18:52:00		0.0275	10	49.7	
07-Oct-98	00:38:00	660	0.055	0	49.79	Connahs Quay 660MW
09-Oct-98	11:11:00	1090	0.035	0	49.84	Hartlepool 610MW followed by Fiddlers Ferry 480MW one minute later
17-Oct-98	08:55:00	650	0.026	0	49.86	Didcot6 650MW
17-Oct-98	09:57:00	1000	0.069	0	49.637	Bipole 2 1000MW
27-Oct-98	11:50:00	1000	0.056	19	49.65	Bipole 1 1000MW
14-Nov-98	11:26:00	1000	0.063	0	49.677	Bipole 1 1000MW
27-Nov-98	11:02:00	637	0.085	0	49.78	Teesside 637MW
27-Nov-98	16:57:00	1095	0.05	0	49.71	Teesside 1 490MW, Teesside 2 605MW instantaneous
28-Nov-98	11:16:00	680	0.018	0	49.73	DIDC B6 680MW
05-Dec-98	10:56:00	1000	0.059	0	49.7	BIPOLE 2 1000MW
19-Dec-98	20:29:00	1000	0.05	0	49.83	BIPOLE 1 1000MW
27-Dec-98	00:21:00	580	0.085	15	49.7	Heysham 1 580MW
27-Dec-98	07:30:00	1100	0.05	2	49.83	Hunterston 1100MW
02-Jan-99	05:05:00	1000	0.078	0	49.65	BIPOLE 2 1000MW
31-Jan-99	16:54:00	600	0.016	0	49.76	Seabank 600MW
14-Feb-99	00:38:00	100	0.037	0	49.75	Unknown
16-Feb-99	18:58:00	1000	0.049	0	49.745	Bipole 2 1000MW
21-Feb-99	11:52:00	1000	0.063	0	49.71	Bipole 2 1000MW
15-Mar-99	12:19:00	720	0.026	0	49.795	Keadby 720MW
27-Apr-99	13:48:00	310	0.025	0	49.75	Drakelow 12 310MW
09-Jun-99	21:47:00	650	0.034	0	49.792	Heysham 28 650MW
19-Jun-99	12:24:00	600	0.041	0	49.8	Hartlepool 1 600MW
28-Jun-99	12:30:00	640	0.046	0	49.85	Hinkley 7 640MW
03-Jul-99	03:32:00	735	0.049	0	49.71	Sutton Bridge 735MW
26-Jul-99	15:55:00	595	0.042	0	49.71	Sizewell B1 595MW
26-Jul-99	15:57:00	593	0.042	0	49.66	Sizewell B2 593MW
14-Aug-99	06:51:00	1188	0.05	12	49.744	Sizewell B 1 & 2 1188MW
14-Dec-99	22:54:00	650	0.035	0	49.719	Hinkley Point B 7 650MW
04-Jan-00	19:11:00	650	0.039	0	49.709	Drax 6 650MW
18-May-00	20:38:00	1200	0.075	22	49.654	Sizewell B 1 & 2 1200MW
03-Jun-00	09:01:00	1140	0.025	0	49.744	Heysham 1140MW
29-Jun-00	15:46:00	1000	0.06	0	49.617	Bipole 1000MW
08-Jul-00	15:54:00	990	0.044	0	49.7	Bipole 990 MW

Network Operations Operational Issues

Inc Date	Inc Time	Size Loss	RoCoF	Generation Lost (MW)	Max Freq reached	LOSS
29-Jul-00	13:55:00	1000	0.037	0	49.694	Bipole 1000 MW
06-Dec-00	13:44:00	1260	0.0725	0	49.684	1260MW Sizewell B
05-Jan-01	08:26:00	1150	0.0475	0	49.632	1150 MW Saltend
10-Jan-01	05:09:00	1260	0.0755	0	49.709	1260MW Sizewell B
16-Jan-01	02:29:00	1170	0.06	0	49.65	1170MW Saltend
12-Mar-01	05:36:00	1100	0.0195	0	49.733	1100MW Longannet
30-Apr-01	11:56:00	1140	0.04	2	49.731	1140MW Saltend
13-Jun-01	17:53:00	930	0.011	0	49.728	930MW Connahs Quay
29-Jun-01	11:56:00	925	0.0235	0	49.799	925MW Connahs Quay
25-Aug-01	14:19:00	1000	0.0575	0	49.726	Bipole
26-Aug-01	16:51:00	1000	0.0575	0	49.709	Bipole
16-Oct-01	06:08:00	1174	0.0675	0	49.735	Sizewell B
22-Jun-02	17:14:00	1170	0.0865	6	49.598	Sizewell B
09-Jul-02	06:29:00	1045	0.0465	2	49.62	Peterhead
19-Oct-02	07:11:00	1200	0.0705	0	49.684	Sizewell B 1200MW
21-Oct-02	08:13:00	1300	0.037	0	49.667	Peterhead 1300MW
26-May-03	01:36:00	1175	0.095	54	49.418	Sizewell B 1175MW
17-Jul-03	11:20:00	1100	0.0565	10	49.633	Saltend 1, 2 & 3
09-Oct-03	10:25:00	-1000	0.02	0	50.219	System Event
11-Oct-03	09:05:00	1000	0.056	0	49.676	Loss of Peterhead 1050MW
24-Apr-04	12:52:00	1000	0.049	0	49.695	Loss of Peterhead 980MW
15-Apr-05	14:44:00	-		0	0	3 phase fault
19-Apr-05	19:05:00	1050	0.0045	0	49.676	Loss of Peterhead 1050 MW
21-May-05	05:52:00	980	0.047	2.3	49.695	Loss of Peterhead 980 MW ,
04-Sep-05	11:50:01	1110	0.0255	0	49.661	Loss of Peterhead 1110MW
04-Oct-05	13:43:00	1122	0.0405	3	49.59	Loss of Peterhead 1122MW
02-Dec-05	22:48:00	1000	0.0205	0	49.751	Loss of Bipole 2 1000MW
10-Jan-06	18:17:00	966	0.055	0	49.685	Loss of all units at Wylfa 966MW
21-May-06	00:16:00			0	-	Elstree-Watford South 1 3 phase fault
22-May-06	15:45:00	1000	0.0565	0	49.632	Loss of Bipole 1 of 1000MW
08-Sep-06	21:29:00		0	0	0	3 phase fault at Lackenby
06-Oct-07	07:52:00	1000	0.0035	0	49.74	1000MW loss on Bipole 2
09-Feb-08	12:34:00	1000	0.0575	0	49.71	1000MW loss on Bipole 2
9-Mar-08	03:22:00	1050	0.0475	0	49.68	Loss of Peterhead 1050MW
21-May-08	11:40:00	1000	0.045	0	49.679	1000 MW loss of Bipole 2
27-May-08	11:36:00	1582	0.073	406.2	48.795	350 MW loss of Longannet followed by 1237 MW Sizewell B
19-Jul-08	01:02:00	1000	0.058	0	49.656	1000 MW loss of Bipole 2
03-Sep-08	09:47:00	1100	0.056	9	49.68	Lon gannet Intertrip Operated
08-Nov-08	22:07:00	1184	0.0695	10.9	49.625	Loss of SIZE-B (Circuit breaker opened at SIZB-1)
29-Jan-09	12:29:00	1190	0.052	0	49.606	Both Sizewell B units tripped
22-Feb-09	07:02	1000	0.0545	0	49.749	Bipole tripped via High frequency relay resulting in loss of 1000MW
09-Jan-10	01:51	1000	-0.0425	0	50.361	Bipole 2 tripped whilst at 1000MW GB to France
19-Apr-11	08:41	1175	0.0705	0	49.667	PEHE-1 Tripped