Paper GCRP 03/27
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Grid Code Review Panel

Annual Summary Report for ROCOF tripping incidents (1 August 2002 to 31 July 2003) by Paul Hurlock

1 Introduction

1.1 This report, for the period 1 August 2002 to 31 July 2003, fulfils the requirement to provide the annual summary of the 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 trips of 1000 MW or more are reported for the above period.

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

2 Background

2.1 The present ROCOF reporting procedure DP123 (Reporting of instantaneous active power losses to DNOs) has been in place since May 1998 and was agreed by Panel representatives.

2.2 The origin of the procedure follows National Grids concern that small 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 Originally, the procedure was triggered for generation losses of 550 MW or more, however this was changed to 1000 MW, and above following the initial review period of May 1998 – July 1999.

3 Summary of notified events during the period of review

3.1 Participants have provided the necessary information, in accordance with DP123, to National Grid following notification, including nil returns.

3.2 The appendix provides details of each notified incident where a generation trip of 1000 MW or more occurred, together with a summary of any reported embedded generation trips subsequently reported to National Grid.

3.3 During the period there have been 4 large generation losses meeting the agreed reporting criteria. These range from 1100 to 1300 MW. Two of these have resulted in

the loss of embedded generation with trips of 54 MW and 10 MW respectively. The other two have no reports of tripping of embedded generation associated with them.

3.4 For these particular incidents the rate of change of frequency, over the initial two seconds of the incident, has varied from 0.037 to 0.095 Hz/second, with the smallest rate of change corresponding to the largest loss. The differences in the rate of change of frequency seen can largely be attributed to the time of day, and hence amount of generation / response on the system, of the loss.

3.5 The 0.095 Hz/second recorded for the loss of 1175 MW on the 26th May 2003 at 01:36 was the largest rate of change of frequency seen since reporting began.

The previous highest was 0.0865 Hz/second on the 22nd June 2002 at 17:14 for an 1170 MW loss.

4 Conclusions from the period reported

4.1 These last twelve months have been consistent with previous experience although new records have been set for the amount of generation tripping for a single incident and rate of change of frequency respectively.

4.2 No incident has resulted in a total generation loss greater than the 1320MW limit quoted in the National Grid Transmission System Security and Quality of Supply Standard.

4.3 The evidence from this years review period supports the conclusion of previous years – namely that the amounts of small embedded generation lost from ROCOF operation following large losses is not significant for the rates of change of frequency experienced during normal operations. This represents little risk to the system as it currently stands.

However, for the event that produced the largest rate of change of frequency so far recorded, 54MW of embedded generation was reported as having tripped. This is the largest tripping of embedded generation following a system event that is known to National Grid at this time. The previous largest reported loss of embedded generation was 48 MW following normal operational switching at Ratcliffe 400 kV substation rather than a large generation loss incident.

4.4 There have been no known enquires regarding the tripping of embedded generation following operational switching in this reporting period. It is not clear if this is because they have not happened or that they have not been brought to National Grid's attention.

4.5 There have been no enquires regarding the tripping of embedded generation following operational switching by National Grid in this reporting period. It is not clear if this is because they have not been happening or that they have not been brought to National Grid's attention.

4.6 The effects of the new electricity market (since March 2001) has not noticeably changed the pattern of large generation losses or ROCOF operation.

5 Recommendations

5.1 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 protection operation (appendix 1) was sent to all DNOs on 7 August 2003.

iii) Endorse the continuation of ROCOF reporting as specified by the DP123 requirements based on the evidence presented above, given the expected increase in embedded generation over the next few years.

iv) Note that National Grid will continue to take interest in any ROCOF protection operation, or other embedded generation tripping mechanism, which is notified from time to time via normal operational liaison.

v) Consider the benefits of increasing the scope of monitoring/reporting of tripping of embedded generation following other rare and significant system events, for example - three phase faults on the transmission system. This would allow any issues arising from an increase in the levels of embedded generation loss to be assessed.

National Grid Transco
August 2003

APPENDIX 1

INCIDENTS OF POSSIBLE RoCoF TRIPPINGS during the period 01/08/02-31/07/03

Notified incidents where there are generation losses of 1000MW, or more, which are likely to lead to the tripping of embedded generation

NOTIFICATIONS RECEIVED FROM RECs/Ilex AND MW LOST WHERE APPROPRIATE														Loss (MW)	Ref
Date	Time	24Seven	EME	Aquila	SSE	YE	SP Power Systems	NEDL	UU	SEE	WPD	WPD Wales	RoCoF (Hz/Sec)		
19/10/02	07:11	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	0.0705	1200	
21/10/02	08:13	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	0.037	1300	
26/05/03	01:36	NONE	NONE	9	NONE	NONE	40	NONE	5	NONE	NONE	NONE	0.095	1175	2
17/07/03	11:20	NONE	NONE	NONE	NONE	NONE	10	NONE	NONE	NONE	NONE	NONE	0.0565	1100	3

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) Aquila report the loss of 6 MW at Bushbury, 2MW at Oldbury and 1MW at Ironbridge.
SPPS report 40MW lost at Frodsham along with 6MW of associated demand
United Utilities report the loss of 5MW at Thornton along with 10MW of process load

3) SPPS report 10MW (est) lost at Carno Wind Farm. Feeds into Leagacy GSP