Frequency Changes during Large Disturbances WG
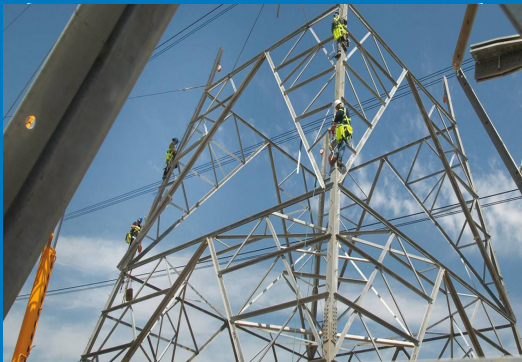
William Hung /Geoff Ray /Graham Stein

Transmission Network Services/ Market Operation

National Grid
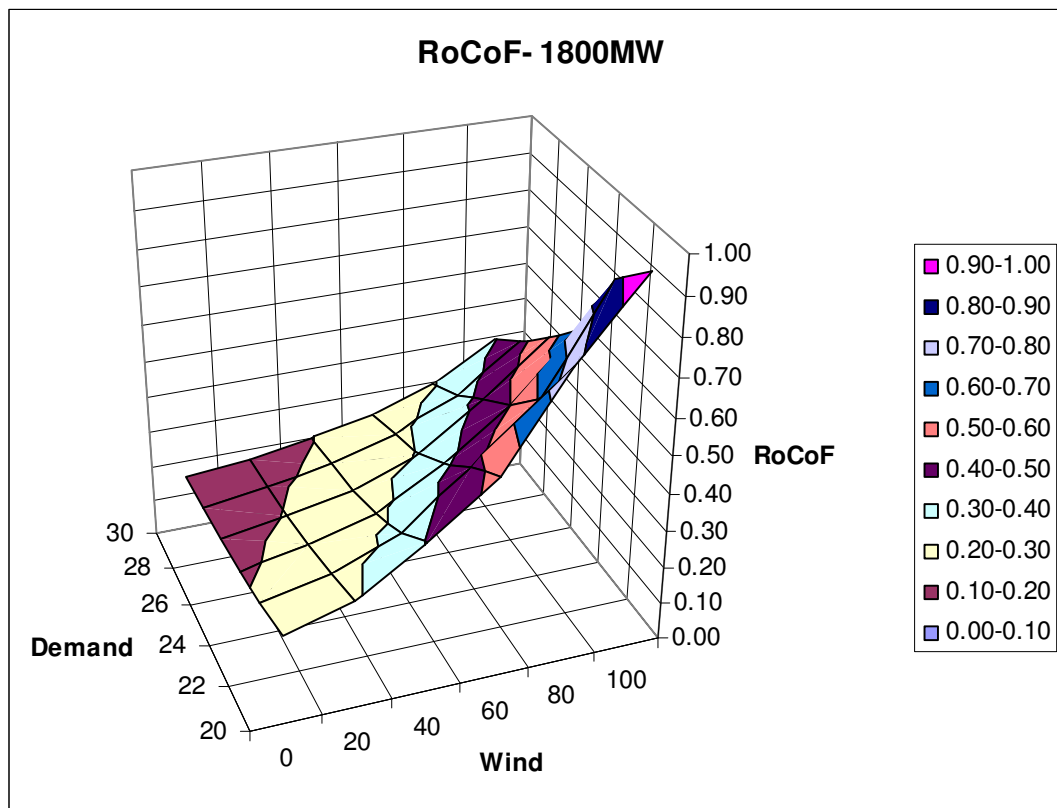
26 October 2012

Background

- LoM protection is designed to detect islanding conditions of small embedded generation…but it has been known to operate unnecessarily under other system disturbance conditions including loss of large generation or infeed

- Industry collaboration effort in the past years has made some improvement but acknowledging that the root cause has not been resolved

- The increase of loss risk to beyond 1320 MW and up to 1800 MW could increase RoCoF to above the threshold level (ie around 0.125 Hz/s) of RoCoF protection

- The volume of embedded generation with LoM protection has significantly increased in recent years and this trend will continue (around 7-8 GW now and 15 GW by 2020)

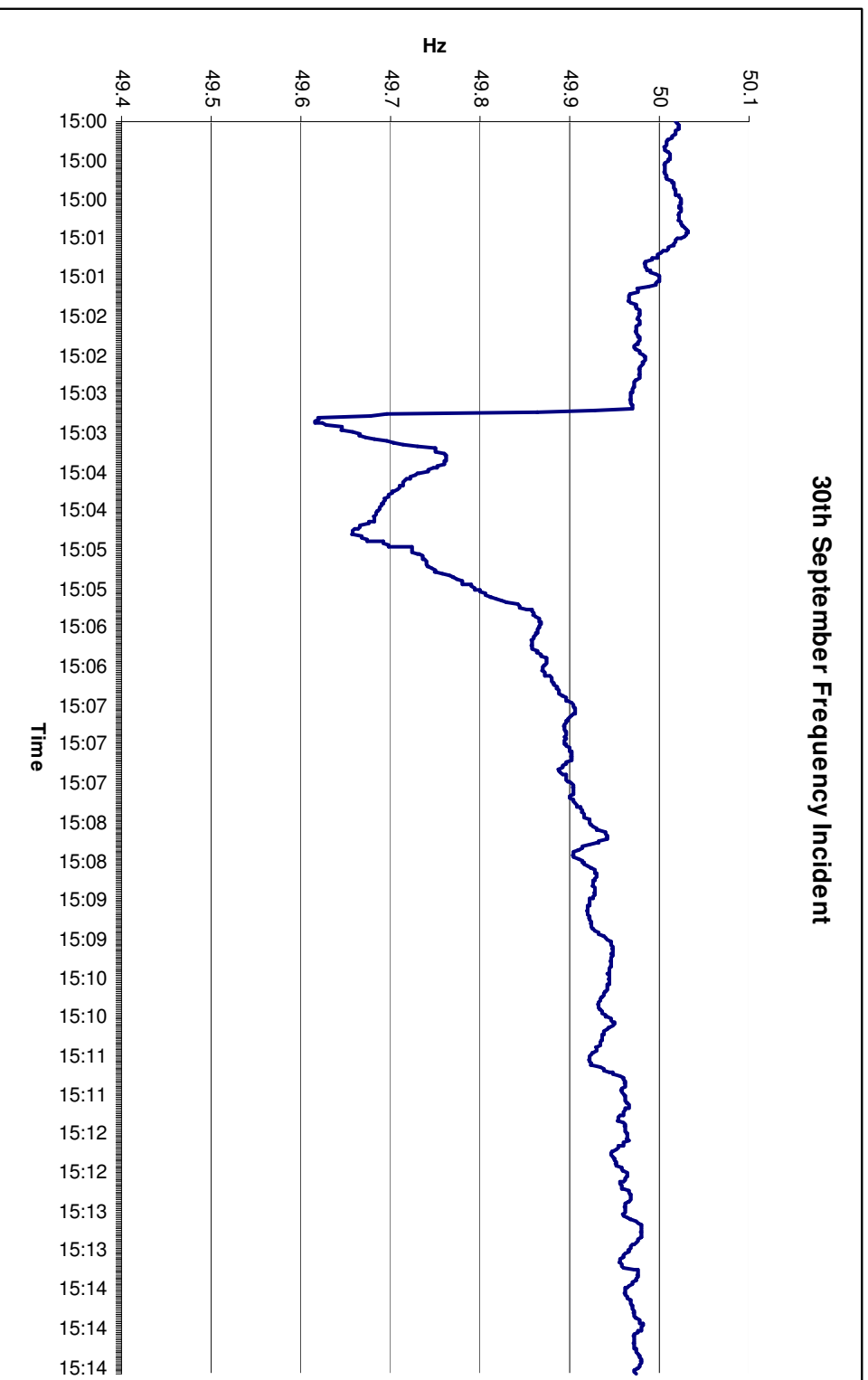# Forecast of RoCoF up to year 2020

- Recent studies from National Grid indicated the expected RoCoF on 1800 MW loss could be much higher

RoCoF- 1800MW

Predicted RoCoF (Hz/s)		
Demand (GW)	20	30
% Wind		
0	0.24	0.15
50	0.48	0.21
100 (= 25GW)	0.97	0.39

30 Sept 2012 Bipole loss Incident

nationalgrid
THE POWER OF ACTION

30th September Frequency Incident

Lessons Learnt from Recent Incident

- Recent interconnector incident (30 Sept) resulted in an effective loss of around 1300MW

- The RoCoF (from PMU data) varied across the network

Area	North	Midland	South
RoCoF (Hz/s)	0.125	0.112	0.102

- RoCoF protection could be triggered in the north depending on RoCoF and timer settings, injection test at Strathclyde University indicated the following outcome

RoCoF setting (Hz/s)	0.17	0.12	0.13
Timer setting (ms)	0	<650-700	<450-500

- Given the protection performance variability, it is important to receive direct feedback from DNOs

Feedback on RoCoF Reporting

- There were two bipole trip incidents in Sept 2012

- RoCoF Report from DNO areas

Date	NOTIFICATIONS RECEIVED FROM DNOs AND MW LOST WHERE APPROPRIATE													
	UK Power Networks			CE Electric		SSE		SP Power		UU	WPD			
	EPN	LPN	SPN	YEDL	NEDL	E&W	Scotland	E&W	SCO		South West	South Wales	East Midlands	West Midlands
28/09/2012	3.6	-	158	12	None	-	None	-	None	27	-	-	-	-
30/09/2012	None	None	102	None	None	None	None	10.4	None	21.9	-	-	-	-

- Reported losses so far are 200 WM and 130 MW for the 28 and 30 Sept incidents respectively

- Thank you for those feedback and we look forward to receiving the remaining information

- Welcome any comments on the data received

national**grid**
THE POWER OF ACTION

Collaborative Effort from the Industry Required

- The simultaneous loss of GWs of embedded generation following a large generation or infeed loss above 1320 MW will be unsustainable

- The change to large contingency loss will be Apr 2014

- Immediate action will be required to ensure the future system will be manageable

- Urgent collaborative effort from the industry is paramount

- National Grid believes the objective of the WG is to provide leadership to the industry to resolve this issue in the most effective way

Initial Thoughts on Minimising System Risks

- New plant connecting in and beyond Apr 2014
    - must not have LoM protection sensitive to RoCoF; or
    - the RoCoF setting must be at or above 1Hz/s and with a minimum timer setting of 0.5 s

- New plant connecting after Apr 2013 but before Apr 2014
    - must not have LoM protection sensitive to RoCoF; or
    - the RoCoF setting must be at or above 0.5Hz/s with a minimum timer setting of 0.5 s with a provision of changing to 1 Hz by Apr 2014

- Existing plant
    - If LoM protection is sensitive to RoCoF, its setting is required to be changed to 0.5Hz/s or above and with a minimum timer setting of 0.5s as soon as practically possible
    - Provision should be made to change to 1 Hz by Apr 2014

… this may be an ideal solution from system security perspective, but…

...How do we get there?...

- What are the issues with the above suggestion?

- What are the implications on the stakeholders?

- What are other options open to us?

- How and when could it be implemented?

- What are the cost implications?

- ...