Minutes

Meeting name	Frequency changes during large system disturbances workgroup (GC0035)
Meeting number	21
Date	22 August 2014
Time	10.30 – 12.30
Location	Ofgem offices, Millbank, London (Teleconference option too)

Future meeting dates

Meeting Number	Date
22	22nd September
23	27th October
24	24th November
25	19th December

1) Introduction & apologies

GS took the role of chair in the absence of MK.

2) Review of previous minutes & actions

The group reviewed the actions from the previous meeting and all other open actions. Updates on actions can be found in the updated latest action log (v5). The group also accepted the minutes from the previous meeting.

3) DNO progress on phase 1

ML advised that SSEPD had set an internal deadline of the next group meeting on 22/9. MW advised that NPG letters were due to go out in September as they were combining the phase 1 information with a data modelling exercise. MW added that NPG intend to use MK's template letter.

MW noted that there may be some generators that indicate they can't change, mainly due to their age. JW asked if it was the relay itself or the equipment behind that can't be changed? MW responded that it was the latter. JD couldn't think of a reason why this would not be possible. ML pointed out that the costs of having to replace a certain number of relays was incorporated in the cost benefit analysis supporting the approved Distribution Code and G59 change.

JD added that we need to be careful that generators understand what's required of them. JD elaborated that some generators had indicated to him they assumed there was a requirement on withstand capability as well as island protection settings.

MW noted that he planned to visit quite a few sites where he knew there were people he could speak to but that there weren't that many over 5MW.

GS suggested keeping an agenda item titled 'Phase 1 progress' so everyone can keep the group updated on any feedback and questions from phase 1 generators. We also expect some people to come back saying they can't change the settings or are having issues. The collective working group should be able to answer any questions that arise.

JW agreed and noted that things seem to be moving slowly but moving nonetheless. He is aware that there's a lot to do in 2yrs (considering risk assessment, mitigation potentially, certainly setting changes) and we don't want to be in situation where there's a rush to get everything finished in the last 8months for example. The sooner this starts the better.

ML advised that he has tried to set multiple deadlines for phase 1 stages (letter out by, replies back by, risk assessment by End of Dec, reminders out in Jan). JW added that from conversations with DNOs, some generators are easy to get hold of, whilst others will be hard to contact. Ultimately, they'll be in breach of the D-code if they don't action this.

JD asked if DNOs will have programmes to make sure these changes happen and what are the consequences if DNOs aren't diligent in this area? Is there a role for someone else to monitor this? JW noted the good question and that ensuring D-code compliance is a DNO responsibility. There wouldn't be any monitoring. MW noted the annual assurance process in line with the reporting process and the fact that DNOs who don't do anything will have to report their activities back to Ofgem who can flag to compliance team. JW added that if a DNO were to inform Ofgem that they had not fulfilled licence obligations, Ofgem would be scrutinising very closely the reasons for this. For example, poor project management would not be considered a very good excuse.

GS expects the DCRP will keep an eye out to monitor progress. JW added that the DNOs know better than Ofgem re implementing D-code changes and have the experience too.

GS noted that these requirements are part of the D-code and should therefore be considered business as usual. JW noted that DNOs have forums, such as this, to raise these issues.

GS summarised that it was important that the letters should go out as planned as this is the best way to ensure that the affected parties knew what was required**.**

The group also discussed progress with providing information on generation below 5MW. ENW, NPG and UKPN had provided a dataset. ML suggested that a formal request for the information might help this process along.

Action GS / SB: Draft a letter to send to all DNOs to request sub 5MW generation data formally (to help DNOs to gather the data)

4) Withstand capability questionnaire

GS summarised the questionnaire for those that hadn't had a chance to look (draft questionnaire was circulated in advance of the meeting). GS asked the group to consider if there was enough context in the questionnaire to capture manufacturers' attention? Are the questions open enough to capture all useful relevant data but at the same time sufficiently targeted? Should we be asking anything else?

AD queried if the first two questions were effectively asking the same thing but GS clarified that Q1 was aimed at establishing if they design for a certain RoCoF level whilst Q2 asks that if they don't, what level do they believe the equipment could withstand. JW asked whether it could be the case, for example, that synchronous generator manufacturers' specify a RoCoF level that can be withstood regularly and also another, higher level, that can only be withstood a handful of times. ML noted that refurbishment may be required after hitting a certain level a certain number of times and JW added that this sort of requirement might be part of the manufacturers' warranty. AD had heard of cases where some manufacturers will guarantee equipment up to certain levels.

MW noted that generators must have a forum that they can all attend to discuss industry issues and asked if there was value in us going to this first to present the questions? He added that we need to get the right questions in order to gather the data we want back. JR suggested we send the questionnaire to AMPS, a generator forum. MW added that it could even be presented at the forum. GS agreed it was useful to get feedback from AMPS. JD suggested maybe even presenting at multiple forums to capture all the different generators (wind, nuclear, large thermals etc.); especially as wind generators will have already considered this in the Ireland context.

ML explained that we have defined withstand as $0.5Hzs^{-1}$ over a 500ms timeframe. However, JD questioned this post-meeting and believes this is incorrect, adding that we have specified a protection setting of 0.5 or 1 Hz/s over 500ms, we have not yet defined a withstand requirement. AD also added some comments post-meeting, saying that he thought we specified the settings 0.5 or 1Hz/s with time delay of 500ms rather than measured over 500ms and that the meaning of time delay was clarified too. AD asked if he was correct? ML continued that it's not the average that's the problem, it's the short term high speed changes that cause real problems and are more akin to vector shift. JD added that the same concerns were expressed in Ireland. Their RoCoF withstand was $1Hzs^{-1}$ over 500ms. The SO refused to provide more detailed data as it was not something they could define. They published RoCoF traces for their last hundred events but that is not especially helpful to them. ML added that generators already tested to worst case. AD noted the highest mechanical impact is on the rotor. Post-meeting, JD circulated an e-mail attachment with links to detailed data on Irish system disturbances including the following link to the publish traces mentioned above: http://www.eirgrid.com/media/Frequency_Transient_Information.pdf

MW noted that there are the same manufacturers in Ireland and so may have already done the work. JD added that they were about to start the work, currently having discussions there on who should pay. GS asked JM if she knew what the timescales are on the Irish withstand work who responded that it could take up to 21months which included studying plant but not including any type of retrofit. GS noted that within the questionnaire he'd add that we are aware of the Irish work. MW asked if they already have the answers in Ireland?

JW couldn't see any reason why we wouldn't be able to see the questions from any Irish questionnaire. GS asked JM if there was a similar questionnaire in Ireland? JM explained that there were more working groups and forums as well as bilateral meetings which acted in lieu of the questionnaire. She added that the regulator was taking a slower approach there.

JD added that EirGrid are managing this for the Republic, whilst SONI are managing for Northern Ireland. JD and JM will review material they have that might be useful and circulate to the group. Post-meeting, JD provided the following link to the Irish program of work for ROCOF (generator withstand and embedded generator protection settings) effective from 30/5/14: http://www.eirgrid.com/media/DS3_RoCoF_Workstream_Implementation_Plan_2014.pdf

GS suggested that we want them to focus their thoughts on the 0.3-1Hzs^{-1} range. ML countered that analysis of the UK grid suggested an average of 1Hzs^{-1} over a 500ms time. Early drafts of ENTSOE's RfG Code asked for withstand of 6Hzs^{-1} with no time specified. During the events of September 2012 it looks like generators would've withstood levels in that order. Some areas get much steeper RoCoF in respect of loss of infeed due to their location.

GS asked how that compares to the 'fault ride through' requirement. ML said that generators were already checked for short circuit faults.

JD asked if we should ask 'do you anticipate RoCoF at x level is more or less onerous on your generator that other considerations that you design for?' ML added that if the answer was yes, we should ask them to justify this.

MW added that the worst case would be a full load rejection, which they're tested to. JD noted that survivability (i.e. in the worst case) may result in the generator staying connected. They might require maintenance for a while but will still ultimately work. ML asked if a short circuit fault would be the most similar to high RoCoF to which MW responded yes, but less than full rejection. Once you open the circuit breakers, energy can only go one way and could still damage bearings. JW highlighted that this uncertainty points to asking more open questions in the questionnaire.

GS agreed this was an important aspect and that we should consider how this fits in with short circuit & full load rejection.

ML noted that some generators will see much higher RoCoF levels and JW commented that this is exactly why you should have a range, to find out exactly what they can cope with.

GS reiterated that the point is to give sufficient context to get good answers. There is the need to acknowledge the transient effect.

GS noted that we can test the questionnaire on larger manufacturers / generators. JR added that we can cover off smaller manufacturers through AMPS.

Action GS / SB: Update questionnaire and circulate for comments

Action JM / JD: Circulate any relevant material on Irish work to help with the withstand questionnaire

Action GS: Speak to larger manufacturers/generation owners re question on withstand capability

Action GS / JR: Arrange for revised questionnaire to be reviewed by AMPS

5) Phase 2

5a) Final comments on proposal

JW highlighted a question about the small range of settings that are being tested and asked if the research would be thorough enough with the current scope. A larger range with the same time delays might give more comparable data and give industry more confidence in any settings selected. Would the WG be comfortable justifying investigation of such a limited range of options to industry?

ML suggested that we see what the Ecofys work comes up with. If 0.1 and 0.3 Hzs^{-1} are without the 500ms time delay then can you use them to plot trend?

GS agreed with JW but added that there is a limit to the number of tests that can be carried out. Need to make provision to look at settings between points of interest. The initial 2 settings may show no need to continue. AD suggested adding 0.3 and 0.7 Hzs^{-1}. JD noted that 0.2 Hzs^{-1} with no time delay represents the existing settings, whilst the others represent new settings so why not represent the existing settings with time delays too?

MW noted the 3 technologies chosen but asked how many technologies are there? AD noted the various combinations within the 3 technologies too. JD added that it's important to the SO that we consider classes that are most prevalent. Also need to identify those that pose a risk.

GS noted that the Ecofys work looks at the generator mix and volumes whilst AD's work quantifies risks for a particular installation type risks The Ecofys work will give us a better view of the actual mix of tehcnologies used.

JW added that Ofgem would want to see that the risk assessments dealt with the most onerous conditions appropriately. AD responded that he planned to cover 3 or 4 main generator technology types. Not many variations in different technologies but within an identified group there can be a lot (especially the inverter group). There aren't many variations in the synchronous generator group as governor response is not relevant in the first few seconds. Induction group is quite clear, unless very tight reactive power compensation: it will not be stable. DFIG (Doubly Fed Induction Generator), mainly for wind, is another group and he has a model for that. MW asked that if those 4 distinct types cover 99% of the population shouldn't we do them all. JW agreed that this was a sensible approach.

AD added that from early studies, both induction and DFIG are less stable than sync. That's why we will assess sync first. Don't know enough about inverter group so will do some tests too on that. Go on the worst case. JW added that if induction and DFIG are less stable than synchronous, and we want to go on the worst case, should we not test induction and DFIG first?

GS expressed his concern about not examining DFIG. MW added that even if we think induction and DFIG will perform similarly, we should include them to avoid any comeback.

AD added that we'll perform some form of comparable stability studies and then we can argue that choosing the most stable is acceptable as we are covering the largest risk. This will provide evidence should we be challenged. There are also some previous studies so may be a case of referencing

these. MW agreed that it's worth showing we have considered everything so if anyone questions our work, we can respond accordingly.

ML asked where you draw the line? AD added that there are almost endless possibilities. MW noted that we may not have to model them but say why we aren't modelling them.

ML agreed that we should cover DFIG machines and perhaps also inverter machines that look like sync generators too. GS would be happy to await Ecofys work outcome and take a steer on the latter point from this. JW said that he was more comfortable with this updated plan of action.

AD summarised that he'd look at lower RoCoF setting values with time delay and the range of the 4 technologies and update the proposal accordingly.

JW added that in phase 1 we did the risk assessment and individual generators also do their own. Phase 2 could affect a significant number of generators. In phase 2 there would be less benefit on smaller generators to do individual assessments. Is it worth thinking about more efficient risk assessment costs? ML agreed and added that you can't expect a 40kW site to complete a £20k assessment. JW commented that this was true unless we could find a method of doing a quick cheap generic risk assessment. GS added that there might be value in a generic risk assessment to cover most plant.

AD suggested some form of multiple choice risk assessment. JW highlighted the potential need to get input from the HSE on phase 2 risk assessment and that it may be worth doing so sooner rather than later.

ML asked if we should consider the frequency response issue in future if Electric Vehicles used? GS added that NGET would know not to specify this type of response where it could impact on loss of mains protection.

ML enquired as to the progress of sourcing inverters for testing. AD responded that he had made use of the contacts provided by JD and that he'd had a positive response from SMA who'd be willing to loan some inverters (single and 3 phase inverters). However, we need more though. Who are the key manufacturers in the UK so we can chase them? GS asked how much an inverter would cost and ML answered that it would be ~£1k. GS suggested that if we cannot loan one then we may have to buy one. JD noted that there are hundreds of manufacturers and that we should focus on the top sellers. ML added that we should use no more than 1 from each manufacturer unless they have a different control philosophy. AD suggested we use a few different manufacturers rather than few different models from the same manufacturer. GS summarised that we need more contacts to try and approach for loaning or just buy one if this proves too onerous.

JD suggested we make contact with the Solar Trade Association and AD added that this should be informed by the Ecofys work.

GS added that we need to give him more contacts if possible. AD added that the costs of potentially hiring or buying inverters had not been included in his current proposals but GS noted that we could separate this out. ML suggested that we need criteria to test inverters.

AD noted that it would be ideal to have all the inverter units at same time as he only has 2 weeks for actual testing. JD suggested that it might be worth contacting Photon International magazine as they test inverters. JD to send contact details to AD. Post-meeting, JD circulated these via the following link: http://www.photon.info/photon_wechselrichtertest_en.photon

GS summarised that no significant comments had been received on the Ecofys proposal. If anyone has any comments, they should make these known ASAP.

Action AD: Update scope to cover lower settings timescales and range of technologies (inc DFIG) and send revised proposal

Action JD: Send additional contacts to AD re inverters (Photon Int'l)

5b) Measurement data requirements

AD summarised the measurement data requirements: 2 points; load profiles; could be anywhere on the network; 11kV and LV circuits; data of 1 second resolution over a day; weekday and weekend examples; summer and winter for seasonality; both P and Q (not all records do).

MW responded that NPG have test data for CL&R project. This will be publicly available in December as a condition of their LCNF bid (any LCNF projects should be able to provide this data) but MW will enquire about the possibility of AD having access to this sooner.

GS noted that the risk assessment is the last stage of work when we know the cross section of the DG network but suggested that it was still worth getting the measurement data requirements pinned down and AD agreed. SB will circulate the measurement data requirements that AD provided.

Action SB: Circulate AD's data requirements to working group for comments

5c) Network configurations

AD noted that he needs network configuration data for his model. GS suggested we progress with MK when he's back. Ecofys expected to join the group for meeting 22.

6) Date of next meeting

22nd September at the ENW offices in Manchester

7) AOB

JW noted that he would always be happy to host future meetings at Ofgem offices in London, if required. NGET would also be able to host if this was required for any reason.

JW also noted that during the Ofgem assessment for phase 1, several issues came up that proved challenging and that these were likely to come up again during phase 2, potentially on a larger scale due to the larger volumes involved. Therefore, he proposes to identify these by way of a letter to MK; the DCRP; the GCRP & our working group. It is expected that all will have visibility of this letter before the next working group meeting on 22nd September. It is proposed that we discuss this at the next meeting as an agenda item.

SB advised that the working group code of GC0035 might be changed as phase 1 has now been approved. SB or GS will advise the group if this happens.

8) Summary of actions

Name	Action	No.	By
GS / SB	Draft a letter to send to all DNOs to request sub 5MW generation data formally (to help DNOs to gather the data)	26	22/9
GS / SB	Update questionnaire and circulate for comments	27	22/9
JM / JD	Circulate any relevant material on Irish work to help with the withstand questionnaire	28	22/9
GS	Speak to larger manufacturers/generation owners re question on withstand capability	29	22/9
GS / JR	Arrange for revised questionnaire to be reviewed by AMPS	30	27/10
AD	Update scope to cover lower settings timescales and range of technologies (inc DFIG) and send revised proposal	31	22/9
JD	Send additional contacts to AD re inverters	32	22/9
SB	Circulate AD's data requirements to working group for comments	33	22/9

Attendees & Apologies

Attendees		
Name	**Initials**	**Company**
Graham Stein	GS	National Grid (Alternative chair)
Scott Bannister	SB	National Grid (Technical Secretary)
Julian Wayne	JW	Ofgem
Mick Walbank	MW	Northern Powergrid
Martin Lee	ML	SSEPD
Joe Duddy	JD	RES
Adam Dyśko	AD	Uni. Strathclyde
Jane McArdle (T-con)	JM	SSE Renewables
John Ruddock (T-Con)	JR	Deep Sea Electronics

Apologies		
Name	**Initials**	**Company**
Mike Kay	MK	ENW (Chair)
Alastair Martin	AM	Flexitricity
Campbell McDonald	CM	SSE Generation
Gareth Evans	GE	Ofgem
Paul Newton	PN	EON
John Turnbull	JT	EDF Energy
Mick Chowns	MC	RWE
Kevin Burt	KB	UKPN
Andy Hood	AH	WPD
Greg Middleton	GM	Deep Sea Electronics
John Knott	JK	SP Energy Networks