

## DRAFT Minutes

<b>Meeting Name</b>	NETS SQSS Sub-Synchronous Oscillations (SSO) Workgroup
<b>Meeting Number</b>	4
<b>Date of Meeting</b>	24 March 2015
<b>Time</b>	10:30 – 14:30
<b>Location</b>	Warwick Hilton, Warwick and Teleconference

## Attendees

<b>Name</b>	<b>Role</b>	<b>Initials</b>	<b>Representing</b>
Graham Stein	Chair	GS	-
Nick Martin	Secretary	NM	-
Bieshoy Awad	Member	BA	National Grid SO
Andrew Dixon	Member	AD	National Grid SO
Cornel Brozio	Member	CB	SPT
David Adam	Member	DA	SPT
Alastair Frew	Member	AF	Scottish Power
Ankit Patel	Member	AP	SSE
John Reilly	Member	JR	EdF

## Apologies

<b>Name</b>	<b>Role</b>	<b>Initials</b>	<b>Representing</b>
Danson Joseph	Member	DJ	National Grid TO
Yash Audichya	Member	YA	SSE
Lorna Short	Member	LS	RWE
Mayure Daby	Authority	MD	Ofgem

## 1 Introductions & Apologies

NM opened the meeting by thanking all of those in attendance. The apologies were also noted.

## 2 Approval of Minutes

The draft minutes from the previous meeting were approved without the need for any changes. These shall now be published onto the National Grid NETS SQSS Website.

## 3 Review of Actions

a) Actions From Previous Meeting:

Action	Description	Action Owner	Due Date
2.0	NGET to raise the issue concerning roles and responsibilities in the management of SSO phenomena at the next Grid Code Review Panel (GCRP) meeting. <i>Update: GS raised this as an issue at the January 2015 GCRP. It remains an issue for this workgroup to resolve.</i>	GS	January 2015
2.3	SHE Transmission to provide the literature they recommend to use as a basis for defining SSO. <i>Update: This action was discussed but remains on-going.</i>	YA	ASAP
3.0	BA to provide some further proposed wording with respect to the background conditions to secure SSO phenomena against and to share this with the workgroup. <i>Update: BA provided additional proposed wording and this was discussed throughout the workgroup meeting.</i>	BA	Next Meeting
3.1	DA to draft a definition of SSO, attempting to include all of the options discussed to date and to share this definition with the workgroup. <i>Update: Whilst a new, complete definition of SSO was not presented, this continued to be discussed and refined throughout the workgroup meeting.</i>	DA	Next Meeting
3.2	The workgroup is to provide a view on the modification proposed to the original criteria. <i>Update: This action was discussed but remains on-going.</i>	ALL	Next Meeting
3.3	NM to circulate a doodle poll to determine the most appropriate date for the next workgroup meeting. <i>Update: This action has been completed and can be closed.</i>	NM	January 2015

## 4 Updated Workgroup Terms of Reference

It was reiterated that the GCRP has recommended that this NETS SQSS GSR018 workgroup provides recommendations on any modifications required to the Grid Code as well as to the NETS SQSS. This has also been ratified by the NETS SQSS Review Panel. As such, the GSR018 workgroup Terms of Reference have been updated to include the provision of recommendations on any modifications required to the Grid Code as well as to the NETS SQSS. These can be found on the National Grid NETS SQSS Website.

## 5 Discussion Items

BA gave a presentation to the workgroup. He started by providing an overview of the current situation in that SSO risks are mitigated mainly by bypassing, tripping or reconfiguring transmission plant. In addition, balancing mechanism (BM) actions may be taken in accordance with User(s) access rights if required. Furthermore, BA explained that some User(s) are required to provide TOs with SSO monitoring signals and some User(s) installing new plant only, although none so far, may be required to provide some SSO mitigation measures. This may take the form, but is not limited to, additional damping controllers. No User(s) have been mandated to install SSO protection equipment.

BA moved on to summarise the progress achieved by the workgroup to date, including: NETS SQSS secured events (as per system stability) and Chapter 4 background conditions (no change) having been agreed.

In addition, BA identified the next steps needed to be taken by the workgroup, including: finalising a definition of SSO, determining Chapter 2 and Chapter 7 background conditions, understanding the connect and manage implications and determining the necessary changes to the Grid Code.

BA moved on to discuss the definition of SSO and the potential overlap this has with transient stability. BA believes that there is no need to be concerned about this overlap, since both conditions still need to be met. BA then presented the definition:

*Sub-Synchronous Oscillations (SSO) are power system oscillations at frequencies that are less than the power frequency. SSO arise from complex modes of oscillation associated with certain equipment in the system such as generator shaft systems, series compensated lines, excitation system controllers, power system stabilisers and converter controllers. ~~For the avoidance of doubt, the subject of SSO does not include transient stability, whose criteria are dealt with under System Instability.~~*

The workgroup discussed that it would be desirable to remove the overlap between the definitions. However, it is difficult to say what we are trying to exclude from the SSO definition without providing a long list. In all cases, the last sentence will need to be either rephrased or completely removed. The workgroup agreed that, although not ideal, the overlap between definitions might not be of great concern.

AF explained that wind farm developers are becoming increasingly concerned about SSO and spoke of a specific situation in which a wind turbine's control system had been damaged. AF therefore queried whether this definition sufficiently covered this issue. BA explained that this definition had been written with wind farms in mind. One suggestion was to include the text "*such as, but not limited to...*" Another suggestion was to simply insert "*wind turbine*" into the definition. GS added that it might be useful to keep the text in red but remove "*for the avoidance of doubt*". With respect to the specific situation described by AF, it was agreed that the workgroup would need a little more information of what actually happened and BA could then update the text as necessary. It was agreed that this would be done offline ahead of the next meeting.

***ACTION: AF and BA to discuss the wind farm incident identified during this meeting offline and BA to update the proposed text as necessary.***

GS explained that there are two audiences: synchronous generator owners and non-synchronous generator owners and we need to try to cater for both and this is one of the reasons we intentionally have a relatively open definition of SSO. GS concluded that the workgroup should settle on what the definition should look like and then test this against different criteria. However, GS did explain that he would be concerned about going to either the GCRP or the NETS SQSS Review Panel and being quizzed about why certain things have / haven't been considered or included within the definition.

BA then moved on to discuss the NETS SQSS: SSO criteria. He explained that the criteria should ensure that no oscillations grow and no oscillations damage generating unit shafts. In addition, at the relevant frequencies, total damping (mechanical damping minus electrical undamping) is always a sufficiently large positive number (i.e. where a potential interaction exists, we want to ensure that the electrical undamping is consistently below the mechanical damping). Furthermore, the criteria should not rule out that positive electrical undamping may exist provided it does not coincide with the relevant frequencies and positive electrical undamping may coincide with the relevant frequencies provided that the undamping is less than the damping.

Next BA presented a slightly modified definition of unacceptable SSO that had been proposed previously. BA had added the text in red and believed that this addressed the concerns of YA from previous meetings.

*Unacceptable SSO are SSO with the relevant modes of oscillation having either: negative or zero total (overall) damping such that the magnitude of oscillations will not eventually decay to zero; or very low positive total (overall) damping such that the combined effect of the low positive damping and the magnitude of oscillation will significantly reduce the lifetime of generator shafts due to fatigue.*

AF queried that this appears to be solely referring to mechanical damping and asked whether anybody had looked at an electrical system model. CB countered that the TO cannot analyse control systems, since in essence it is just a "black box". The TO can only pass the electrical characteristics to the owners of wind farms so that they can confirm with the turbine manufacturers if there are any significant risks. GS asked the workgroup if this definition was therefore ok. There seemed to be moderate support from all other workgroup members.

However, GS warned the workgroup members to bear in mind that this definition will most likely be challenged at the GCRP and NETS SQSS Review Panel.

Next BA presented with respect to the NETS SQSS Chapter 2 background conditions. BA explained how that for SSO we study the relevant condition, which is minimum damping, and typically occurs when the plant is synchronising or desynchronising. BA presented two proposed options:

- i) Provide specific background conditions for SSO studies.
- ii) Do not provide specific background conditions for SSO studies and assume that the TOs / OFTOs will provide operational measures to allow NGET to operate the network while the generator is synchronising / desynchronising in accordance with General License Condition D3 and E16.

DA raised concerns about being too specific with respect to the background conditions, arguing that there is a balance to be had between modifying the standards and covering off these criteria explicitly. DA therefore questioned whether this level of detail was necessary and whether the existing text did not already suffice. BA explained that the proposed definition of SSO will require modifications to Chapters 2, 4 and 5. GS concluded that we shall proceed with Option 1. However, we would need to clearly state that there are several options with regards to the legal text. BA added that what hadn't yet been agreed was whether we need to explicitly specify that the TOs have to look at specific backgrounds or whether we leave it to be their choice. GS believed that there needs to be a certain amount of transparency in what we expect transmission licensees to do. BA concluded that this is looking at the same secured events as transient stability; however the generator will be assumed to run at different output levels (background conditions).

Following lunch the workgroup moved on to discuss the Connect and Manage implications. BA presented a graphic that illustrated the area of greatest concern is when interactions between existing transmission plant and a new generator wishing to connect to the transmission system results in unacceptable SSO. The concern is that if the interactions identified are encountered in post fault conditions, the works required to mitigate these interactions might not be automatically classified as Enabling Works. BA pointed out that this question might be academic since SSO related works are unlikely to be in the critical path of the generator connection. The workgroup agreed that, although unlikely to occur, the concern should be acknowledged and addressed if within the scope of the workgroup.

BA pointed out that under Connect and Manage, post fault NETS SQSS criteria usually triggers Wider Works and the resulting constraints are dealt with via market mechanisms. However, for SSO related constraints, the new plant will be permanently constrained. The workgroup agreed that there will be a significant operational risk if the User is allowed to connect ahead of the completion of the SSO related reinforcements. It may be possible to deal with the consequences via an Operational Intertripping Scheme. However, the workgroup agreed that this is not ideal since if the works were not originally classified as Enabling Works, the Operational Intertripping Scheme wouldn't fall under any of the categories currently covered by the Grid Code or Connection and Use of System Code (CUSC).

The workgroup concluded that any works required to meet the SSO criteria within the NETS SQSS have to be complete ahead of the connection in order to allow NGET to operate the transmission system in a safe manner and to allow NGET to meet the Grid Code requirements as proposed under GC0077. Hence these works need to be classified as Enabling Works. This is, as far as the workgroup is concerned, already covered by CUSC 13.2.4.3 and CUSC 13.2.4.5.

CUSC 13.2.4.3 Enable The Company to operate the National Electricity Transmission System in a safe manner; or

CUSC 13.2.4.5 Comply with the minimum technical, design and operational criteria and performance requirements under the Grid Code.

The workgroup moved on to discuss how that an inter-trip may not always resolve the issue and that generation may need to be curtailed also. However, it was agreed that this would be far from ideal and that preferably we wouldn't find ourselves in a situation where inter-trips were required because this would imply that there were SSO events on the transmission network. Hopefully actions would have been taken to negate these issues in advance of the machine being connected.

The workgroup, having raised the concern and provided a view on the classification of the works, decided that any additional recommendations on this point would fall outside the scope of the workgroup. It was therefore agreed to make note of and explain this view within the workgroup report.

Finally the workgroup moved on to discuss the Grid Code and any potential changes required as a result of their discussions. The workgroup discussed that SSO monitoring equipment is best installed on User(s) plant and hence it is likely that TOs will require some User(s) to install such equipment. The workgroup discussed how that if a User wishes to install SSO protection they would do so at their own risk and with no liability on NGET or the TOs if the protection trips. However, User(s) should at least inform the TO and potentially agree the settings with the TO. AF said he believed it was already a requirement to provide this information. It was also queried that if a User trips as a result of their own protection, could National Grid be held accountable? BA confirmed he would prefer no liability on transmission licensees whatsoever. AF and JR confirmed that generators would not pay for protection if they did not believe it was required. GS suggested that these queries were resolved offline.

***ACTION: BA to confirm the requirements on User(s) who wish to install monitoring equipment and / or protection and the implications of this on National Grid.***

The workgroup also discussed the Grid Code modification GC0077. This has been circulated for industry consultation and a number of high level questions have been raised as a result. Although the workgroup felt that these were fairly generic and high-level, it was still agreed that we would need to demonstrate how these had been addressed. These include but are not limited to: license standards, User(s) plant being exposed to additional risks, monitoring and protection and clarity on the responsibilities of new versus existing User(s). It was however agreed that the last of these is outside the scope of this workgroup's terms of reference.

To conclude, GS queried whether the discussions held with respect to wind farms had changed anything? This is to be resolved offline. CB also stated that this workgroup should consider roles and responsibilities, since he believed this would be raised at either the GCRP or NETS SQSS Review Panel regardless. DA also raised two data issues that the workgroup should be aware of with respect to mechanical damping and fatigue data.

## 6 Any Other Business

None

## 7 Next Meeting

It was agreed that the next step should now be to draft a workgroup report and to circulate this to all workgroup members for comment. This would then be discussed via teleconference and followed up by another face-to-face meeting if necessary.

***ACTION: BA and NM to draft a first pass workgroup report and circulate to all workgroup members for comment by late April / early May 2015.***

***ACTION: NM to circulate a doodle poll to determine the most appropriate date for a workgroup teleconference and / or meeting as required.***

## 8 Summary of Actions

a) On-Going Actions:

Action	Description	Action Owner	Due Date
2.3	SHE Transmission to provide the literature they recommend to use as a basis for defining SSO.	YA	ASAP
3.1	DA to draft a definition of SSO, attempting to include all of the options discussed to date and to share this definition with the workgroup.	DA	ASAP
3.2	The workgroup is to provide a view on the modification proposed to the original criteria.	ALL	ASAP

Otherwise all actions from previous meetings have been previously discussed and / or closed.

b) New Actions:

Action	Description	Action Owner	Due Date
4.0	AF and BA to discuss the wind farm incident identified during this meeting offline and BA to update the proposed text as necessary.	AF / BA	Next Meeting
4.1	BA to confirm the requirements on User(s) who wish to install monitoring equipment and / or protection and the implications of this on National Grid.	BA	Next Meeting
4.2	BA and NM to draft a first pass workgroup report and circulate to all workgroup members for comment by late April / early May 2015.	BA / NM	May 2015
4.3	NM to circulate a doodle poll to determine the most appropriate date for a workgroup teleconference and / or meeting as required.	NM	May 2015