NC HVDC User Group - 3rd meeting

Date: 12 September 2013
Time: 10h30 – 16h00
Place: ENTSO-E offices, Brussels

MINUTES

Participants	Affiliation	Present	Excused
Stakeholders			
Magnus CALLAVIK	ABB		X
Peter LUNDBERG	ABB	X	
Marcelo FERRAZ	ALSTOM Grid UK	X	
Andrew McINTOSH	BritNed		X
Damian BACH	BritNed		X
Torsten HAASE	Dong Energy	X	
Muhammad JAFAR	DNV	X	
Simon LUDLAM	Eleclink	X	
Angus NORMAN	Eleclink	X	
Ton GERAERDS	Eurelectric	X	
Jean-Baptiste COGNAT	Eurelectric		X
Paul WILCZEK	EWEA	X	
Ivan PINEDA	EWEA	X	
Frans VAN HULLE	EWEA	X	
Jan SUCKOW	FNN/VDE	X	
Stijn COLE	GDF Suez		X
Ara PANOSYAN	GE Global Research		X
Emad AHMED	GE Global Research		X
Stephen MILLAR	Iberdrola Engineering		X
Mukund BHAGWAT	IFIEC		X
Petter LONGVA	IFIEC		X
Michelle MANNING	Mitsubishi Electric		X
Steve LANGDON	Mitsubishi Electric		X
Joe Corbett	Friends of the Supergrid	X	
Mike WILKS	Pöyry		X
Eckhart LINDWEDEL	Pöyry		X

Kim WEYRICH	REpower		X
Christian FELTES	RWE Wind		X
Gavin GREENE	Scottish Power	X	
Frank SCHETTLER	Siemens	X	
Manfred POHL	Siemens		X
Kamran SHARIFABADI	Statoil		X
Ifigeneia STEFANIDOU	Swisselectric	X	
Chuan ZHANG	The Crowne Estate		X
Peter Wibæk	Vestas Wind Systems A/S	X	
Michael ALDERS	VGB PowerTech	X	
Helge REGBER	VGB PowerTech	X	
Claudio GIANOTTI	World Energy SA		X
Mario GENOVESI	World Energy SA		X
Philippe ADAM	CIGRÉ B4-56		X
Uros GABRIJEL	ACER	X (webconf)	
Andrius CIALKA	OFGEM	X	
Maarten KLIJN	Autoriteit Consument & Markt NL	X	
Tadhg O'BRIAIN	EC		X
Wilhelm WINTER	TenneT GmbH	X	
Thomas AHNDORF	Transnet BW	X	
Pascal BERTOLINI	RTE	X	
Darren CHAN	National Grid	X	
Carmen LONGÁS VIEJO	REE	X	
Mark NORTON	EirGrid	X	
Jürgen SCHMITT	Swissgrid	X	
Helge URDAL	National Grid	X	
Edwin HAESEN	ENTSO-E Secretariat	X	
Ádám SZÉKELY	ENTSO-E Secretariat	X	

1. Introduction

ENTSO-E welcomed all participants. The proposed the agenda of the meeting was accepted.

ENTSO-E has previously sent to all members of the User Group a working version of the draft Network Code HVDC (dated 2 September 2013), reflecting the current status of work. It is noted that this draft does not represent an ENTSO-E endorsed position and is open for suggestions before internal ENTSO-E approval to enter a formal consultation. Public consultation on a further refined and complete version of the Code is expected to start early November 2013 for a two-month period.

The outcomes of the previous User Group meeting (11 June) were briefly discussed. The objective of the 3rd User Group meeting was to discuss the details of the draft code provided per article, collect feedback to utilise the expertise of the User Group for further amending the draft Code, and to identify whether any crucial issue exists which should be resolved before public consultation.

2. Detailed discussion of articles

Some of the participants prepared a short presentation to support their key feedback. These presentations are available together with these minutes:

- FNN
- ABB
- Siemens
- EWEA

In order to allow more time for discussion on requirements for DC-connected Power Park Modules was addressed first, however, for better readability, this summary follows the order of Articles as in the draft Network Code.

Only key comments on content are listed below. Nevertheless, minor or editorial comments have been noted, are much appreciated and all will be assessed by the drafting team.

The immediate responses to some comments are already indicated below (as discussed at the meeting), while due consideration will be given to all comments by the drafting team.

CHAPTER 1 - GENERAL PROVISIONS

***Article 1* - Subject-matter and scope**

Par. (3)d: Eurelectric: criteria for demonstration of cross-border effects or reference to Article 3(3) to be added

Par. (10): Eleclink: the method for assignment and the framework of cooperation in case several TSO(s) are concerned should be clarified. ENTSO-E explained that this general clause will be included in all Network Codes by which the appointment of certain TSO(s) for certain tasks falls under national competence. Another general clause describing the frame of coordination between TSOs and NRAs is foreseen to be included.

***Article 2* – Definitions**

It is acknowledged that definitions need to be as clear as possible. Work on definitions of NC HVDC, compatible with other codes, is still ongoing. Suggestions are welcome.

Article 3 - Regulatory aspects

No comments.

Article 4 - Recovery of costs

No comments.

Article 5 - Confidentiality obligations

No comments.

CHAPTER 2 - GENERAL REQUIREMENTS FOR HVDC CONNECTIONS

SECTION 1 - REQUIREMENTS FOR ACTIVE POWER CONTROL AND FREQUENCY SUPPORT

Article 6 - Frequency ranges

An explanation on how frequency and voltage withstand capabilities are related is requested to be included in the supporting documents, similarly to NC RfG. ENTSO-E clarifies that the interpretation of RfG and DCC is still valid for NC HVDC.

ABB: Clause on "the consent of the HVDC System Owner shall not be unreasonably withheld" should be better explained.

Siemens notes that the frequency ranges proposed are wider than those in NC RfG and that this may result in a cost increase. ENTSO-E argues that network assets should keep their integrity during system events at minimum as long as generation/demand has to remain connected. ENTSO-E welcomes more detailed info on the impact of the proposed capability, as also requested in the Call for Stakeholder Input.

Article 7 - Rate-of-change-of-Frequency withstand capability

Vestas: a clearer definition of measuring Frequency deviation (df/dt? time window? …) would be welcomed.

Article 8 - Active power controllability; control range and ramping rate

Par. (1)a/iii. Eleclink: how is coordination assured between TSOs for issuing request?

- The connection codes require the existence of procedure and technical capability as mentioned in the paragraph, the distribution of roles for issuing orders is an operational issue, to be covered in connection agreements or elsewhere.
- General clause on coordination between TSOs and NRAs to be proposed in a later draft

Par. (1)b. Scottish Power: 'as fast as technically feasible' needs further clarification (ensuring that no technology or specific vendor is excluded due to this requirement)

- The meaning is that no intentional, additional delay is introduced. There is no restriction on design, choice of technical solution or manufacturer implied.

Par. (1)c. Eleclink: 2 seconds for active power reversal from full load to full load in the opposite direction is too ambitious, such changes cause major stress on the cable insulators.

- Such fast active power reversal is expected extremely rarely (maximum few times throughout lifetime) and only in case of extreme events, otherwise the AC system capabilities are more limiting

- Only few occurrences of activation of this function have only little impact on lifetime cost (confirmed by Alstom and Siemens)

Par. (1)d. Eurelectric, Siemens: Terms FCR, FRR, FSM, as well as "static and/or dynamic means" needs clarification or explicit definition

- Terminology as used and explained in NC LFC&R, to be clarified in the NC HVDC indeed.

Article 9 - Synthetic inertia

Vestas: the term "inertia" is related to generation. Input signal and control law of such functions can be very different to this for HVDC. It should be specified more precisely in order to implement an adequate control (e.g. what is 'Frequency change'?).

- Being overly specific at this point would hamper free development of technology
- The term synthetic inertia already covers that it is different but supporting the grid in a similar way.
- Size of synchronous area determines to a large extent how fast the system issue of decreasing total inertia is reaching problematic levels, studies showing that in smaller areas, it could already endanger operation within a few years, therefore a requirement is needed already, but cannot yet be determined in a more specific manner.

Article 10 - Frequency Sensitive Mode (FSM)

Par. (1)c. Eurelectric: possible ranges for active power available for FSM should be defined in Table 3. Time limitation may also be necessary to be specified.

- Agree that this specification is needed.

Par. (1)e. Eurelectric: Specification is needed on which end of the link this requirement applies to and which frequency is predominant

- Agree that both ends cannot have conflicting operation modes. Connection code describes the capabilities at all connection points (measurement, control, activation times, response times, …), while further agreements and coordination is still needed..

Article 11 - Limited Frequency Sensitive Mode Overfrequency (LFSM-O)

No comments.

Article 12 - Limited Frequency Sensitive Mode Underfrequency (LFSM-U)

No comments.

Article 13 - Frequency control

No comments.

SECTION 2 - REQUIREMENTS FOR REACTIVE POWER CONTROL AND VOLTAGE SUPPORT

Article 14 - Voltage ranges

Par. (1)a. EWEA: the proposed voltage ranges are considered to be too wide

- Voltage ranges are not wider than for other grid users. ENTSO-E argues that network assets as HVDC systems should remain their integrity during system events at minimum as long as generation/demand has to remain connected. ENTSO-E welcomes further info on the impact of the proposed capability.

Par. (1)b. Eleclink: Last sentence of paragraph pose unilateral obligations to HVDC System Owners, therefore should be removed or amended to create "symmetric" conditions and rights with TSOs.

- Utilizing an existing capability of an HVDC link for staying connected to the network under certain voltages and/or for certain periods of time is not considered a market service as such, but is in the common interest of all grid users to ensure system security and is therefore requested from all grid users in a non-discriminatory and proportional manner.

Article 15 - Short circuit contribution during faults requirements

No comments.

Article 16 - Reactive power capability

Figure 5: ABB: a rectangular U-Q envelope has significant cost implications (e.g. delivery of high reactive power at high voltage deviations). EWEA and Siemens also question the necessity for a rectangular envelope.

- The requested U-Q/Pmax curve can take any shape within the envelope (it does not need to be rectangular, nor take the dimensions of the inner envelope), will be based on local system needs and will be subject to regulatory oversight.

FNN- VDE: It is necessary that the reactive power requirements can be defined within the national implementation process- therefore the application of Art. 3(3) is important. However, the defined values for Maximum Range of Q/Pmax and Steady-State Voltage Level seem to be unnecessarily high

- The envelope is a max boundary, it does not represent a Q/Pmax profile itself. Based on system needs, different capabilities may be required at different connection points, to be specified within the relevant national processes.

Siemens: Capability "in every possible operating point in the P-Q/Pmax capability diagram defined by the relevant TSO …" may not always be needed. The requirement may result in an unnecessary cost increase, especially in cases where LCC based HVDC would be economically attractive.

Article 17 - Reactive power exchanged with the Network

No comments.

Article 18 - Reactive power control mode

Par. (4)c. Siemens: For LCC, where AC filters/shunt reactors are used for reactive power control, the operator selectable range must be below the steady state AC voltage limits since otherwise the maximum limit (design limit) is exceeded when the filter/shunt reactor is switched. This is especially valid for the overvoltage level.

- The intention of the article is that the design of the HVDC System should take this into account.

Article 19 - Priority to active or reactive power contribution

No comments.

Article 20 - Power quality

Allowed level of harmonics should be described.

SECTION 3 - REQUIREMENTS FOR FAULT RIDE THROUGH

Article 21 - Fault ride through capability

Figure 6: Siemens: possible conflicting interpretation with Art. 15: it needs to be clarified that if blocking is allowed and happens under fault conditions, short-circuit current contribution is not possible.

- Article 15 is not mandatory, if required, the parameters of Article 21 have to be determined such that blocking is not allowed.

Figure 6: Siemens, Eurelectric: caption text and definition of T_{blc} needs further clarification

Table 7: Vestas, Siemens: Maximum value of 10 seconds for T_{rec} is unnecessary and unrealistically long. Recovery times requested in projects so far go up to about 1.5s maximum. The long recovery time up to 10s is especially critical for the auxiliary systems which normally cannot be considered separately from the HV system.

***Article 22* - Post fault active power recovery**

No comments.

***Article 23* – Autoreclosure**

Siemens: distinction should be made in the requirements depending on fault type (3-phase or single-phase), and whether the fault occurs on the last feeding AC line to a converter station or not.

- Note that the HVDC system is connected to a substation, so it is deemed reasonable to require the HVDC system to remain connected for all types of autoreclosures.

SECTION 4 - REQUIREMENTS FOR CONTROL

***Article 24* - Converter energisation and synchronisation**

No comments.

***Article 25* - Interaction between HVDC System(s) and other Connections**

Par. (1). VGB: the party bearing the cost of studies should be specified.

- Connection codes do not cover cost allocations for any requirement.

***Article 26* - Power oscillation damping capability**

EWEA, Siemens: The capability for power system damping will also depend on the available wind power.

- In future situations with more converter based RES and less synchronous generation, it is deemed justified to ask for the basic capability from all HVDC systems.

***Article 27* - Sub-synchronous torsional interaction damping capability**

Siemens: The TSO should provide detailed input parameters (listed in separate document) to enable a sub-synchronous torsional interaction study for generators which might be prone to SSTI.

- The provision of all necessary data to enable SSTI studies is already included in the article as far a risk for the occurrence of sub-synchronous resonances is detected.

Par. (2). VGB: the party bearing the cost of studies should be specified.

- Connection codes do not cover this in detail.

***Article 28* - Network characteristics**

Par. (1)c. FNN – VDE: The requirements regarding harmonic network conditions require clarification. Is it the TSO that should define the necessary harmonics? On what basis?

***Article 29* - HVDC System robustness**

No comments.

SECTION 5 - REQUIREMENTS FOR PROTECTION DEVICES AND SETTINGS

Article 30 – Reconnection

No comments.

Article 31 - Electrical protection schemes and settings

No comments.

Article 32 - Priority ranking of protection and control

Par. (2). Vestas: possible conflict between points (b) and (c)

- (c) is not always applicable, and triggers are different

Article 33 - Changes to protection and control schemes and settings

No comments.

SECTION 6 - REQUIREMENTS FOR POWER SYSTEM RESTORATION

Article 34 - Black start

Par. (2): Eurelectric: better phrasing needed in order to describe that external energy supply cannot be relied on *on the side that is being energized.*

Article 35 - Isolated network operation

No comments.

Article 36 - Modernisation, development and replacement

No comments.

CHAPTER 3 - REQUIREMENTS FOR DC-CONNECTED POWER PARK MODULES AND HVDC SUBSTATIONS CONNECTING DC-CONNECTED POWER PARK MODULES

Scottish Power noted on the general approach of the Chapter that building system solutions for possible development in 10 to 20 years is not appropriate and creates unnecessary technical and financial burdens. ENTSO-E noted that a gradual add-on of further components may lead to an overall sub-optimal solution; furthermore, studies show that some of the issues to be solved are foreseen to occur well before the mentioned time period.

Article 37 - Frequency stability requirements

Par. (1). Several participants expressed that the formulation “HVDC Substations which are AC Connected to DC-connected Power Park Modules” is not sufficiently clear.

FNN – VDE asked whether it is necessary that all requirements listed in Articles 6 to 36 are applicable for HVDC substations which are AC connected to DC connected PPM? In particular, EWEA asked whether Article 9 on synthetic inertia also applies to PPMs as stated in paragraph 1. ENTSO-E will look further into which requirements should be applicable to remote end HVDC converter stations and to DC Connected PPMs, to avoid ambiguity.

Swisselectric noted that a differentiation between HVDC substation and converter station definitions may be necessary (implying a change in the definitions of Chapter 1, Art. 2 and of the title of Chapter 3). The specific proposal, to be sent after the meeting, will be assessed.

Par. (3). Siemens requested clarification on why the frequency withstand range for HVDC systems is different from that of PPMs. It is also noted that the proposed frequency ranges are not the same as in EN 50160. ENTSO-E clarified the overarching principle that HVDC links are considered as transmission network assets, therefore are expected to be the last ones to disconnect. The requirements in NC RfG and NC HVDC, applicable for system users, are minimum requirements, therefore it has to be anticipated that some of them will have wider inherent capabilities. All elements of the transmission system need to be reliable and robust for serving the most users in a cost-efficient way. Nevertheless, the relationship and differences between the two frequency range tables in NC HVDC, as well as the one in NC RfG shall be explained further in the supporting documents.

EWEA noted that the lowest range (47.0 – 47.5 Hz) needs to be justified. ENTSO-E notes that no cost impact date was received in the Call for Stakeholder Input (where a range of 45-55 Hz was suggested), but welcomes any further input. Furthermore as presently such a range is already applicable in the UK and as well in Germany with a wider frequency range for DC connected PPMs.

Par. (4). EWEA noted that the difference between value in this paragraph and Article 7 needs to be justified. The main reason, similarly to the previous item, is that stricter standards apply to transmission system assets than to other elements. Furthermore, ENTSO-E is open for suggestions in case a significant difference in cost implications exists between a requirement of 2 Hz per second as opposed to 2.5 Hz per second.

Par. (5). DONG Energy noted that “fast signal response” needs to be specified (possibly with reference to paragraph (2)a). EWEA noted that the method for determining the response should also be described.

Article 38 - Reactive Power and Voltage requirements

Par. (3). Eurelectric, EWEA, Scottish Power: why is a differentiation necessary based on ownership?

- This approach allows more room for optimization and utilisation of possible synergies if the PPM and the link connecting it to the main AC system are owned by the same entity. Note that there is no discrimination as nothing precludes similar optimization on a bilateral agreement basis if ownership differs.
- FNN – VDE and DONG Energy also noted that the large reactive power capability (as described in paragraph (3)a/iii.) in foreseeably small AC islands seems overly onerous. It is also questionable whether different voltage ranges are needed as in RfG. ENTSO-E agrees that the possibility of later linking of such small islands cannot be excluded. The referred requirements are non-exhaustive in RfG, with need for justification of system need and regulatory oversight during national implementation. The option to prescribe a single maximum envelope for all ENTSO-E areas will be considered.

Par. (7). Eurelectric: Blocking for lowest voltages should also be allowed for PPMs as for HVDC converters. ENTSO-E argued that for short circuit faults in the DC connected AC collection system all grid users have to provide short circuit currents in order to allow a fast, reliable, secure and selective protection and disconnection of the fault. This is quite important in order to minimise the loss of generation. Comment to be assessed further.

Article 39 - Control Requirements

Par. (3). Vestas questioned the reasons behind value of 2 per cent given. In general, existing standards, grid codes, etc. have to be observed (according to Framework Guidelines), with specific justification to be given in case of deviation.

Par. (5). FNN - VDE: "optimum response" should be better defined or deleted

Par. (6). FNN – VDE; DONG Energy: Interaction of 2 different Synchronous areas – HVDC converter has to react to onshore inter-area oscillations, PPMs have to react to oscillations in the offshore island. Such cases are most likely best dealt with on a case-by-case basis.

Par. (7). Siemens: "torsional interaction" needs more clarification.

***Article 40* - Network characteristics**

Par. (2)c. Siemens, VGB: Needs further explanation on which party delivers what to whom.

***Article 41* - Protection requirements**

No comments.

***Article 42* - Power Quality**

EWEA: level of distortion should be specified more precisely.

***Article 43* - General System Management Requirements applicable to DC connected PPMs**

No comments.

CHAPTER 4 - INFORMATION EXCHANGE AND COORDINATION

Not discussed in detail during the meeting, some User Group members provided written comments in their presentations attached to these Minutes.

3. Next steps

Further written comments are welcome, as soon as practicable.

A draft code will be published for consultation in mid-November 2013. During the approximately two-month consultation period, a public workshop in Brussels, and information sessions in various countries organised by the TSO are foreseen.

The next User Group meeting is to be held shortly after the end of the public consultation period, in order to give an opportunity to members to elaborate on their responses provided.

Everybody's active input and constructive feedback in this meeting is much appreciated.