

HVDC and DC Connected PPM Network Code User Group Meeting Brussels 12 March 2013

Preliminary Scoping

Preliminary Scope – HVDC considerations



- Why is HVDC included in Network Codes on European level?
 - It's inherent capabilities – fast active and reactive power control, supplementary control, etc. can help the EU to achieve its three energy goals
- Why are DC connected PPMs included?
 - HVDC as combination to PPMs could bring economic benefits
 - Coordination between HVDC and PPMs needed capability
- Requirements should not favour or discriminate technology
- Requirements for HVDC connections and DC connected PPMs should not be a barrier to future expansion into multi-terminal or mesh DC grids (onshore/offshore)
 - Mesh DC grids are not included
 - Standardisation issues are part of separate activities

Preliminary Scope – ACER's FWGL

“The network code(s) developed according to these FWGL* shall apply to grid connections for **all types of significant grid users**, already or to be, connected to transmission or distribution network.”

“Any grid user **not deemed to be a significant grid user** shall not fall under the requirement of the network code(s)”

“Significant Grid Users – **pre-existing** grid users and **new grid users** which are deemed significant **on the basis of their impact on cross border system performance** via influence on the **control area's security of supply**, including provision of ancillary services”

**Framework Guidelines on Electricity Grid Connection issued by the Agency for the Cooperation of Energy Regulators*

http://acernet.acer.europa.eu/portal/page/portal/ACER_HOME/Public_Docs/Acts%20of%20the%20Agency/Framework%20Guideline/Framework%20Guidelines%20On%20Electricity%20Grid%20Connections/110720_FGC_2011E001_FG_Elec_GrConn_FINAL.pdf

Preliminary Scope - Significant Grid Users

Power Park Module(s) AC collected and DC connected to the main electricity system

HVDC connections between AC collected PPMs and the main electricity system

HVDC connections between synchronous areas or between control areas including back to back

HVDC connections embedded within one control area

— Connection Point(s)

Preliminary Scope – Significant Grid Users



Should the following configurations be treated as significant?

- HVDC connections between synchronous zones or between control areas inside the same synchronous zone
- HVDC connections embedded within one control area, if connected at AC transmission voltage – if connected below transmission level?
- HVDC connections to offshore and onshore Power Park Modules
- HVDC connected Power Park Modules (AC collected)

... single and radial Multi-terminal HVDC connection types, Back to Back

What categories of requirements do we need for different significant HVDC connection systems?

- Active power control and frequency support
- Reactive power control and voltage support
- Fault ride through
- Control
- Protection devices and settings
- Power system restoration

Preliminary Scope –Frequency Related Requirements

POSSIBLE REQUIREMENTS FOR ACTIVE POWER CONTROL AND FREQUENCY SUPPORT ?

- Frequency ranges
- Rate of change of frequency withstand capability
- Active power controllability; control range and ramp rates
- Synthetic inertial capability
- Frequency sensitive mode
- Limited frequency sensitive mode (overfrequency, underfrequency)
- Frequency control
- Maximum loss of active power

Preliminary Scope –Voltage Related Requirements

POSSIBLE REQUIREMENTS FOR REACTIVE POWER CONTROL AND VOLTAGE SUPPORT ?

- Voltage ranges
- Short circuit contribution during faults
- Reactive power capability
- Reactive power compensation
- Reactive power control mode
- Priority to active or reactive power
- Power quality



POSSIBLE REQUIREMENTS FOR CONTROL ?

- Converter synchronisation/disconnection
- Control interaction between converter station and PPMs
- Power oscillation damping
- Subsynchronous torsional interaction damping
- Operability at minimum short circuit power
- Converter operational robustness
- Grid controller

Preliminary Scope – Protection Requirements



POSSIBLE REQUIREMENTS FOR PROTECTION DEVICES AND SETTING ?

- Re-Connection post contingency
- Electrical Protection Schemes and Settings
- Control Schemes and Settings
- Priority Ranking of Protection and Control
- Changes to protection schemes and settings – coordination and agreement

Preliminary Scope – Restoration Requirements

POSSIBLE REQUIREMENTS FOR POWER SYSTEM RESTORATION ?

- Black start capability
- Capability to take part in isolated network operation



POSSIBLE REQUIREMENTS FOR POWER PARK MODULES ?

- Requirements at converter AC interface point
- Requirements as in RfG, with possible variation in ranges and settings
- Additionally, also needs to meet requirements as per HVDC connections
- PPM and HVDC connection need to have economic consistent coordinated requirements so as not to impair requirements at AC onshore transmission connection point

POSSIBLE REQUIREMENTS FOR INFORMATION EXCHANGE AND COORDINATION ?

Adequate and coordinated information exchange between operators of HVDC and PPMs and TSOs is necessary to fulfil several objectives.

- Operational strategy
- Parameter setting
- Fault recording and dynamic performance
- Fault and disturbance analysis
- Simulation models

Preliminary Scope – Compliance and Derogation

POSSIBLE REQUIREMENTS FOR COMPLIANCE AND DEROGATION ?

- Compliance shall be demonstrated according to Operational Notification Procedure for connection
- The derogation procedure for non-compliance shall be transparent , non-discriminatory and based on cost benefit analysis

Discussion

Power Park Module(s) AC collected and DC connected to the main electricity system

HVDC connections between synchronous areas or between control areas including back to back

HVDC connections embedded within one control area

HVDC connections between AC collected PPMs and the main electricity system

— Connection Point(s)