EirGrid plc

HVDC Interconnectors

Proposed Grid Code Modifications

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1. Introduction

1.1 There are a number of developers developing HVDC Interconnectors between Ireland and other jurisdictions. To cater for these potential developments the Grid Code needs to be updated. This will require a significant update and additional clauses in the Grid Code, particularly with respect to the scheduling and dispatch codes. This proposed modification deals with the General Conditions, Planning Code, Connection Conditions and Operational Code.

2. General overview of changes

2.1 Broadly speaking we are dealing with two types of HVDC Interconnector technologies, HVDC Lite and HVDC Classic. The Grid Code must account for the long term benefits of the Irish power system and the capabilities of the technologies in question.

On examination of the technologies it would appear that HVDC Classic is a more proven technology with higher MW capabilities whereas HVDC Lite is more flexible but only proven at lower MW ratings. The clauses presented here tried to capture the differing aims of meeting the long term needs of the power system without imposing unreasonable constraints on the current technological capabilities.

3. Section by Section Review

3.1 Planning Code

The main objective of the planning code is to ensure the appropriate supply of information from users of the transmission system to the TSO. The planning code obligates the user to supply the relevant planning data to the TSO within the appropriate timelines and in addition it grants the TSO the right to seek additional information where necessary. The proposed clauses ensure the HVDC Interconnectors are included in these rights and obligations.

3.2 Connection Conditions

The Connection Conditions define the standards for the method of connection to the transmission system, these standards include the technical, design and operational standards. This section also deals with the normal transmission system performance standards at the connection point together with the types of signals and indications that are required from each user by the TSO.

Specifically Connection Conditions try to ensure that any user of the system can perform Fault Right Through (FRT), Active Power Capability and Control, Reactive Power Capability and Control, Power Quality and Signals.

FRT

HVDC Interconnectors need to remain connected to the system at voltage and frequency deviations similar to conventional generators. In relation to HVDC Classic technologies there are known issues in connecting to systems with low short circuit levels (this is a result of thyristor controlled technology which requires current to switch off each individual gate). The minimum short circuit level set is an attempt to indicate that it is an expectation of HVDC Interconnectors that they will continuously operate on the system for all credible system configurations both now and at least for the next twenty years. Consideration is also required of the Government policy to have 40% of electricity from renewable sources by 2020.

Active Power Capability and Control

Interconnectors do not in themselves provide any generation they facilitate the transfer of electricity from one region to another. In this regard the capabilities of the Interconnector need to be reasonably flexible. There appears to be no major issues with either technology in meeting these reasonable standards.

The most limiting constraint for HVDC Classic appears to relate to the polarisation of the cable. It is understood that the manufacturers' cable design allows for a relatively slow turn around from a flow in one direction to another. However studies indicate that (ref All Island Grid Study) use of interconnection from maximum flow in one direction to maximum flow in another direction is an important factor in meeting the Government renewable targets of 40% by 2020. The proposed ramp rates try to acknowledge this. There is no such limitation for HVDC Lite.

Reactive Power Capability

It is a reasonable expectation from all generators that they can provide a degree of controllable reactive power capability and response. Interconnectors are tie lines between two regions and are not generators. Specifically while HVDC Lite has a full and responsive reactive power capability HVDC Classic does not. Indeed on investigation it would appear that the dynamic control of the reactive power is not possible. Therefore the proposed clauses acknowledge these differences. HVDC Classic is obligated to meet all its own Reactive Power requirements throughout its full range of its operational capability.

Power Quality

The proposed main clauses obligate the Interconnector to remain connected and operational to a system with a reasonable amount of negative sequence current. As well as not adversely affecting the power quality specifically harmonics.

Signals

The proposed clauses obligate HVDC Interconnectors to provide MW, MVAr and control signals.

3.3 OC2 Operational Planning

This section defines the notification procedure of outages and the procedure by which the indicative, provisional and committed outage programmes are reviewed by the TSO. The proposed clauses bind the notification procedure for outages to HVDC Interconnectors.

3.4 OC4 System Services

This section sets out the voltage and frequency control capabilities that are required by users. There are specific clauses in the proposal that deal with HVDC Interconnectors. It is the intention that all HVDC Interconnectors shall have the capability when acting as demand to reduce their consumption of electricity in an extreme low frequency situation. Likewise if it is acting as a generator the HVDC Interconnector shall, as a minimum, maintain up to at least 95% of its dispatch level. Both of these measures are required to protect system energy balance.

In addition there is a capability required for interconnections that will allow them, in emergency situations, to move from the current level to a maximum output in either flow direction. While it is envisaged that this will be used infrequently the capability needs to exist.

3.5 OC7 Information Exchange

This section sets out the requirements for the exchange of information in relation to operations and events on the power system which have had or may have an operational effect. Information exchange will be required from HVDC Interconnectors.

3.6 OC8 Operational Testing

This section deals with the responsibilities, obligations and rights for arranging and carrying out operational tests which may have an effect on the systems of the TSO and users. This section must also cover the testing of HVDC Interconnectors.

3.7 OC9 Emergency Control and Power System Restoration

The proposed change includes HVDC Interconnectors under this operational condition.

3.8 OC10 Monitoring, Testing and Investigation

The primary aim of OC10 is to provide rights to the TSO to monitor, test and investigate the compliance of users. The proposed clause includes HVDC Interconnectors under these rights.

3.9 OC11 Safety Co-ordination

The objective of this section is to ensure the TSO, users and their respective agents to operate in the accordance with the approved safety rules. The proposed clause applies to HVDC Interconnectors as a user of the transmission system.

3.10 Glossary Changes

A number of new definitions are required in the glossary table of the Grid Code. Existing definitions, such as Forbidden Zones and Grid Connection Point, need to be updated to make provisions for HVDC Interconnectors.