

Connection Arrangements for Offshore Renewable Generation

Consultation

Deadline for responses: 30 May 2013.

Contents

1	Introduction	1
2	Background.....	2
3	Responding to this consultation.....	4
4	Key Areas for consultation	6
5	Options for Physical Connection Arrangements and Wider Transmission System Reinforcements	7
5.1	Introduction	8
5.2	Connections to the Transmission Network and Distribution Network	8
5.3	Onshore Points of Connection and Individual Radial Connections	11
5.3.1	Establishing Connection Assets	12
5.3.2	Distribution Connections	12
5.4	Radial Transmission Connection.....	12
5.4.1	Variation One - Transmission Radial Connection - combined TO/Developer build	12
5.4.2	Variation 2 - Transmission Radial Connection - TO Build	15
5.4.3	Variation 3 - Radial Connection - developer build.....	19
5.5	Radial Distribution Connection	21
5.5.1	Distribution Connection Variation 1 (Developer build)	22
5.5.2	Distribution Connection Variation 2 (Onshore Cluster)	22
5.6	Alternative Connection Arrangements	24
5.6.1	Offshore Network Providing Onshore Network Reinforcement and Offshore Connections	25
5.7	Conclusion	26
6	Ownership, Responsibilities and License Arrangements.	27
6.1	Introduction	28
6.2	IME3 Unbundling	28
6.3	Ownership, Licenses and Responsibilities	28
6.3.1	Alternative Option 1 Extend the Present TO Transmission Network Offshore.	29
6.3.2	Alternative Option 2 - The Present System Operator Takes Ownership	30
6.3.3	Alternative Option 3 Introduce New Licensed Offshore Transmission Owners	31
6.4	Offshore connections at Distribution Voltages	32

6.5	Conclusion	32
7	System Security, Least Cost Technically Acceptable (LCTA) Connection Design, Cost Allocation and Charging Arrangements.....	33
7.1	Introduction	34
7.2	System Security, LCTA, Cost Allocation and Charging Arrangements.	34
7.3	Conclusion	37
8	Changes to the Connection Application Process and the NI Connection Queue.	39
8.1	Introduction	40
8.2	Proposed Changes to the Connection Application Process and the NI Connection Queue.	41
8.3	Conclusion	42
9	The need for changes to the Grid Code.	44
9.1	Introduction	45
9.2	The need for changes to the Grid Code.	45
9.3	Conclusion	46
10	What Happens next.....	47

1 INTRODUCTION

The Utility Regulator (UR) is tasked with regulating within Strategic Policy set by government. UR's principal objective is to protect consumer interests, wherever appropriate, by promoting effective competition. The duties of UR also include regulation of the electricity transmission and distribution networks in Northern Ireland. UR must ensure that suitable modifications to existing regulations, licenses and codes are put in place to accommodate the connection of future offshore wind and other marine renewable generation and in doing so ensure the interests of consumers are best served.

The following consultation is part of the UR process to ensure an appropriate regulatory system is in place to accommodate the connection of offshore wind and other marine renewable generation. The consultation will also ensure that all key stakeholders are given an opportunity to express their views regarding the proposed regulatory changes.

A number of key areas to facilitate the connection of offshore renewable generation have been identified. Potential options have been developed by the UR and are presented for review, discussion and feedback by interested parties.

2 BACKGROUND

NI Government Strategic Energy Policy, as set out in the Strategic Energy Framework 2010, is to achieve 40% renewable electricity in the supplied energy mix by 2020. This target is aimed at improving environmental sustainability and providing energy supply security and will ensure Northern Ireland meets EU legislation and targets.

The renewable electricity mix will include an element of offshore wind, and tidal generation. The ORESAP¹ (Offshore Renewable Energy Strategic Action Plan) 2012-2020 initiated by the DETI has an overall aim to optimise the amount of renewable electricity sustainably generated from offshore wind and marine renewable resources in Northern Ireland waters. The associated development opportunity identified is for up to 600 MW of offshore wind and 200 MW from tidal resources in Northern Ireland waters by 2020.

A Strategic Environmental Assessment (SEA)² carried out by the DETI on the ORESAP identified a number of zones to be considered for either offshore wind or marine tidal generation. The Crown Estate engaging with industry early in 2011, confirmed market demand in two zones identified in the SEA for development:

- The offshore wind area, off the south east coast of County Down, for a single development company to deliver up to 600 MW of generating capacity, see Wind Resource Zone 2 in Figure 1.
- The Rathlin Island and Torr Head Strategic Areas, a tidal stream area of up to 200 MW capacity, see Tidal Resource Zone 2 in Figure 1, for delivery of multiple projects and applications were invited for projects of a range of sizes up to 100 MW.

¹ Offshore Renewable Energy Strategic Action Plan 2012 -2020, Department of Enterprise, Trade and Investment (DETI), March 2012.

² Strategic Environmental Assessment (SEA) of Offshore Wind and Marine Renewable Energy in Northern Ireland, Department of Enterprise, Trade and Investment (DETI), December 2009.

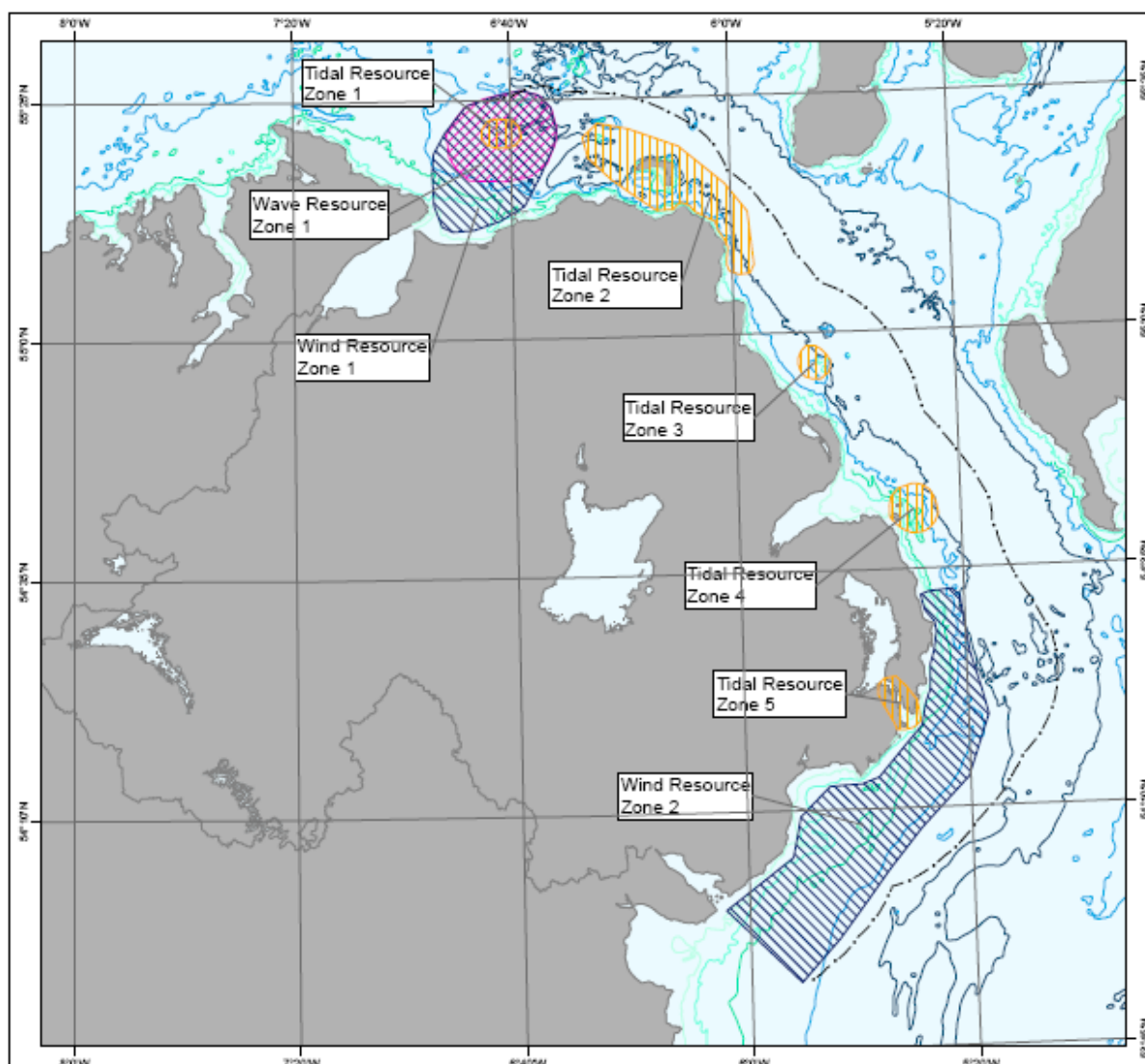


Figure 1- Offshore Renewable Energy Development Zones identified by the DETI¹

The first offshore leasing round was conducted by The Crown Estate, with the rights to develop offshore renewable energy projects offered to the three successful consortia announced in October 2012. The granting of these first development rights will lead to the necessity for grid connections for the offshore generation. As these are the first offshore renewable projects in NI waters, new connection arrangements which deal with the relevant issues, require to be developed and put in place by the UR.

3 RESPONDING TO THIS CONSULTATION

UR would like to hear the views of interested parties in relation to any of the issues set out in this consultation document, including both general views on the subject areas and specific response to the sets of questions raised.

We would especially welcome responses to the specific questions which we have set out at the beginning of each chapter heading.

Responses should be sent to the postal address or email address indicated overleaf no later than 30 May 2013. Our preference would be for responses to be submitted by e-mail, although hard copy responses are also welcome.

Unless marked confidential, all responses will be published by placing them in UR's library and on our website³. Respondents may request that their response is kept confidential. UR shall respect this request, subject to any obligations to disclose information, for example, under the Freedom of Information Act 2005. Respondents are asked to put any confidential material in the appendices to their responses.

3.1 Section 75 of the Northern Ireland Act 1998

As a public authority, the UR has a number of obligations arising from Section 75 of the Northern Ireland Act 1998. These obligations concern the promotion of equality of opportunity between:

- i. Persons of different religious belief, political opinion, racial group, age, marital status or sexual orientation;
- ii. Men and women generally;
- iii. Persons with disability and persons without; and
- iv. Persons with dependants and persons without.

The UR must also have regard to the promotion of good relations between persons of different religious belief, political opinion or racial groups.

In the development of its policies the UR also has a statutory duty to have due regard to the needs of vulnerable customers i.e. individuals who are disabled or chronically sick, individuals of pensionable age, individuals with low incomes and individuals residing in rural areas. Some of the above equality categories will therefore overlap with these vulnerable groupings.

In order to assist with equality screening of the proposals contained within this consultation paper, the UR requests that respondents provide any information or

³ <http://www.uregni.gov.uk/>

evidence in relation to the needs, experiences, issues and priorities for different groups which they feel is relevant to the implementation of any of the proposals. Furthermore, the UR welcomes any comments which respondents might have in relation to the overall equality impact of the proposals.

How to respond

Any questions on this document and responses should be directed to:

Brian Mulhern
Electricity Directorate
Queens House
14 Queen Street
Belfast BT1 6ED
Tel: +44 (0) 28 9031 6333
E-mail: Brian.Mulhern@uregni.gov.uk

This paper is available in alternative formats such as audio, Braille etc. If an alternative format is required, please contact the office and we will be happy to assist.

4 KEY AREAS FOR CONSULTATION

The purpose of this consultation is to assist with decisions on regulatory changes that may be required to facilitate the connection of offshore renewable generation to the onshore electricity network. In setting out this consultation a number of boundary conditions have been established, including:

1. Changes to legislation have not been considered. DETI is currently consulting on the offshore legislative requirements and will be bringing forward an Offshore Renewable Energy Bill. UTILITY REGULATOR and DETI are working in parallel concerning offshore generation.
2. The consultation extends only to the connection of the offshore renewable generation for the three offshore projects where the development rights were recently awarded by The Crown Estate.

The key areas considered for consultation are set out in the following sections and include:

- Options for Physical Connection configurations and Wider Transmission System Reinforcements;
- Ownership, Responsibilities and License Arrangements;
- System Security, Least Cost Technically Acceptable (LCTA) connection design, Cost Allocation and Charging Arrangements;
- Changes to the Connection Application Process and the NI Queue for new connections;
- Impact and changes to the Grid Code; and

In consulting on the various aspects of offshore renewable generation connection, UR would like to understand the position of all involved parties and is open to other potential realistic options in addition to those outlined in this consultation paper.

5 **OPTIONS FOR PHYSICAL CONNECTION ARRANGEMENTS AND WIDER TRANSMISSION SYSTEM REINFORCEMENTS.**

Chapter Summary

Section 5 presents a number of generic transmission voltage connection options (110 kV and above) aimed at larger generation schemes and distribution connection options (below 110 kV) for smaller generation schemes or tidal schemes where connection technology may lead to power being landed onshore at distribution voltages even for larger capacity schemes. All of these options are based on radial connections from the offshore wind turbines for smaller schemes or offshore collection substations for larger schemes to a point of connection onshore.

At transmission level three variations of connection are considered where the design and build is the responsibility of the developer or the existing SO and TO or both parties.

For smaller offshore generation schemes in Tidal Zone 2 there are a number of reasons why power may be landed at distribution level voltages even if ultimately power has to be stepped up to transmission voltage onshore to export power from the local onshore area. Since IME3 unbundling regulations do not apply for distribution, developers should retain ownership of the offshore connection assets and be responsible for their design, installation, maintenance, operation, decommissioning and financing. The offshore assets would be covered by the developers' generation license.

The concept of creating an offshore transmission network to connect offshore generation has been considered briefly, however, it is difficult to identify benefit in this alternative option. Hence this option has been ruled out as not feasible.

Questions to Respondents

With reference to the radial transmission connection variations discussed, UR is interested to receive views on the following issues as well as views on any other aspect of the physical connection arrangements and wider transmission reinforcements required:

- Preferred transmission connection variation and reasoning.
- Potential Offshore substation ownership boundaries;
- Usage and need for a near shore substation;
- Procurement and build of the offshore substation and connection to the onshore network

5.1 Introduction

In exploring the physical options for the connection of offshore generation in NI territorial waters UR has considered key factors which are relevant to NI and NI electricity consumers as well as the government 2020 targets for renewable electricity consumption in the electricity mix.

The UR also has a duty to protect consumers in NI ensuring benefits are realised and costs minimised. This includes not only the cost of developing, installing, maintaining, operating, financing and decommissioning new offshore connection assets but also the additional resources required to license and regulate offshore transmission. These factors have guided UR to develop a number of potential options in terms of the connection of offshore renewable generation into the NI network. We are seeking views and responses to the options that have been outlined in this paper.

In terms of the physical connection arrangements, potentially the most straight forward option is to consider offshore connection arrangements as individual radial connections to on shore connection points (either new or existing Transmission or Distribution network connection substations). This pragmatic approach has been influenced by a number of unique factors including the:

- small size of the NI seabed for development;
- short distance from shore of development zones, and
- cost implications to a smaller market.

The influencing factors are explained in greater detail in the following sections.

When examining the connection options the issue of shallow connections, firm connection offers and deeper network reinforcements have also been considered.

5.2 Connections to the Transmission Network and Distribution Network

The Crown Estate has recently granted development rights for projects within two offshore zones as discussed earlier.

Wind Resource Zone 2, 600 MW off the south east coast of County Down

The project off the south east coast of Co Down is for a single development of up to 600 MW of generating capacity. A wind farm of this capacity would require to be connected directly into the NI transmission network with export circuits landing power to shore at transmission level voltages e.g.110 kV. Due to the short distances to shore DC export connections would not be cost effective and AC power transmission circuits would be employed. While the developers are currently considering their proposals, for the purpose of this consultation we will assume that for the 600 MW wind zone in NI, 2 offshore substations each with two or three export circuits to shore. These two offshore substations would be run independently of each other effectively

creating two 300MW wind farms or interconnected offshore to form a single 600MW offshore wind farm.

Such developments are to be considered in the context of the present Planning & Security Standard, PLM_SP_1. The standard requires the following to be adhered to:

1. "2.1.1. It shall be possible to operate a generating station, whose maximum output does not exceed the two largest sets on the system, at maximum output during a prolonged outage of one of the connecting circuits" i.e. if there are two circuits connecting the generator each rated at 50% of the generator capacity then a third 50% rated circuit would be required to cater for a circuit outage."
2. "2.1.2. No single fault (other than a bus section or bus coupler circuit-breaker fault) shall cause the instantaneous loss of generation greater than the sent out capacity of the largest authorised generator.... on the system."

The NI Amendment Sheet – Issue 2 also states:

"Stations with a sent out capacity in excess of 550 MW will normally be connected via at least four circuits."

Point 1 is a requirement to have an N-1 transmission connection. In considering the options for transmission level connection of offshore generation the need for an N-1 connection is raised.

If the wind farm is split into two wind farms, each with 300 MW capacity, then this would fall into point 2.1.2 of the Security Standards referenced. This suggests that a single circuit would be acceptable to connect a set lower than the largest set (550 MW), as long as it doesn't exceed the 20km maximum length, (see clause 3.4.2 of PLM-SP-1).

A differentiation may be required between the Planning & Security Standards applying to connections and to the system. The system, beyond the connection point, must be capable of accepting the generation and there are various other standards that have to be met. The chargeability rules consider these separate aspects i.e. the definition of what constitutes Connection Assets and what constitutes System Assets and how these are separately treated. NIE and SONI are currently undertaking a review of the Planning and Security Standards.

Tidal Resource Zone 2, 200 MW area around Rathlin Island and Torr Head

The Crown Estate has offered development rights to two 100 MW tidal projects at Torr Head and Fair Head. The voltage used for the collection of tidal stream energy and connection to the onshore network will be dependent on a number of factors including:

- The capacity of the scheme, stated as anything up to 100 MW.
- The available space and routes for landing connection cables.
- The turbine output voltage and development of submersible collection systems that may step up the voltage for longer distance sending of power to shore.
- The economics of collecting energy offshore and stepping up to higher voltages for transmission to shore verses collecting power at an onshore substation and stepping up to a transmission voltage.

Consideration of these points may determine whether a developer opts for a transmission voltage level connection to shore (e.g. 110 kV) or a distribution level voltage (e.g. 11 kV or 33 kV). The likely hood is that there could be connections that will land power to shore at a distribution voltage level, even if ultimately the power has to be stepped up to a transmission voltage at an onshore substation for export out of the local distribution area. If there is insufficient capacity on the adjacent 110/33kv network then all associated works, transmission included, would be considered as part of the connection arrangement.

It is likely that there will be two developers within Tidal Zone 2 that will require connections and if much of the power ultimately has to get to a transmission voltage the concept of a single substation providing a connection for a cluster of generation schemes may be an attractive solution. This is the proposed scheme in the area of NI around Tidal Zone 2 for onshore wind projects. Figure 2 is an extract from NIE's Cluster⁴ plan for onshore wind farms also indicating the location of Tidal Zone 2 and the local transmission network.

⁴ NIE Cluster Plan, updated 28 Feb 2012.

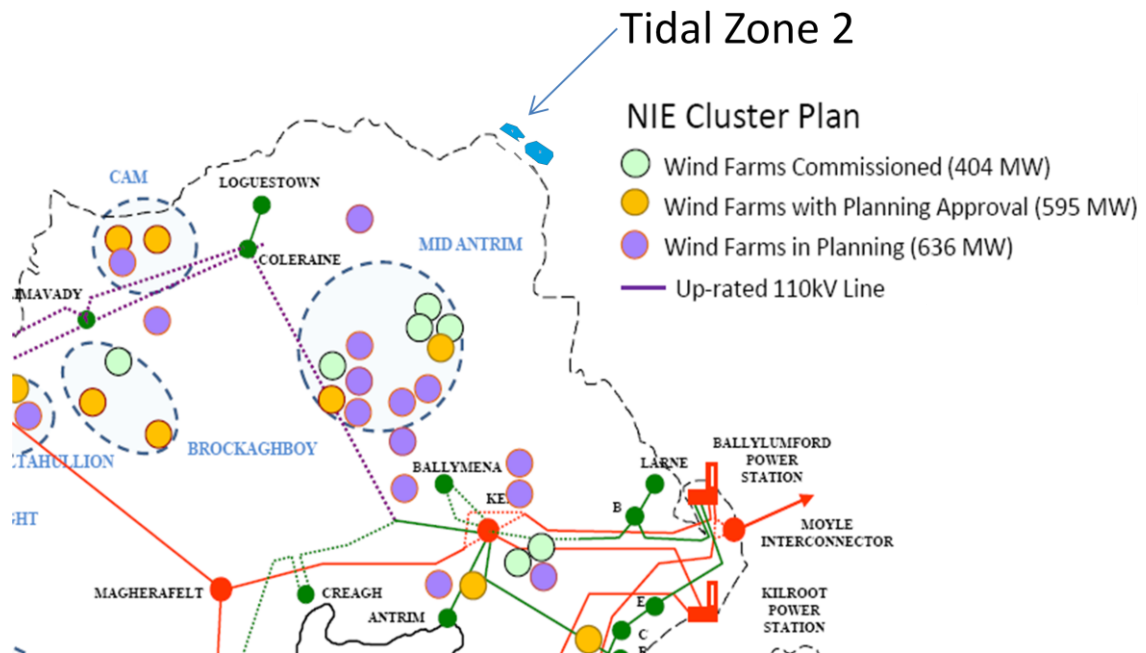


Figure 2 - Extract from NIE's Cluster Plan 2012 Showing Tidal Zone 2

Options for radial connections from offshore generation schemes to shore at distribution voltage is therefore also covered in this consultation.

One key difference of a distribution connection to that of a transmission voltage level connection is that IME3 unbundling asserts that an electricity transmission owner cannot exercise control of an electricity generation or supply company, but this does not apply to distribution activities. In NI everything below 110 kV is considered a distribution activity.

5.3 Onshore Points of Connection and Individual Radial Connections

This section presents a set of variations for onshore transmission and distribution connection points with radial connections to offshore generation that are designed for illustrative purposes only and are not proposed as design arrangements. Hence, no voltages or circuit ratings are indicated in the associated figures and the number of radial circuits is for illustration.

The illustrated connection figures are used throughout this document to assist in the consultation of a number of the key areas outlined earlier. Where necessary, reference to existing network arrangements will be made to expand on the illustrated connection arrangements.

5.3.1 **Transmission Connections**

The options for transmission level radial connections assume power delivery from the offshore generating facility to shore at voltages of 110 kV or above. For power delivery at these voltages IME3 unbundling requirements have to be considered in terms of who will own the transmission connection assets upon completion of construction. In broad terms, IME3 means that an electricity transmission owner cannot exercise control of an electricity generation or supply company, and vice versa.

A number of potential ownership arrangements have been considered in section 6. It is important to note that the utility regulator will not consider any arrangement option which is felt to fall foul of IME3 requirements.

5.3.2 **Distribution Connections**

The options for distribution level radial connections assume power delivery from the offshore generating facility to shore at voltages below 110 kV which would typically be expected at 11 kV or 33 kV depending on the connection capacity requirements and the circuit lengths involved. Power delivery below 110 kV is assumed not to be impacted by IME3 unbundling requirements and hence could be owned and maintained by the offshore generation scheme developer.

5.4 **Radial Transmission Connection**

This section presents three variations for radial transmission connections: It is important to note that these options have been developed with the explicit intent of providing an illustration of potential options to promote discussion within this consultation paper. These options are purely illustrative and have not been discussed or agreed with SONI and are presented in this paper to raise issues and seek feedback.

- Variation One – Combined TO/Developer build
- Variation Two – TO build
- Variation Three- Developer Build

5.4.1 **Variation One - Transmission Radial Connection - combined TO/Developer build**

Transmission radial connection variation 1 is associated with larger generation schemes where a transmission level connection would be required.

Transmission radial connection variation 1 is based on NIE building new substations close to the shore landing point of the marine cables, see Figure 3.

These substations would be connected to the existing electricity network under existing rules on system security (Planning Memorandum PLM-SP-1 plus Amendment Sheet Issue 2⁵) and may require upgrades and reinforcement to the existing transmission network (deep or shallow reinforcements or both).

The offshore connection elements in Figure 3 are assumed to be owned and operated by the developer and existing rules on system security would not apply with the developer deciding on the level of security they require. This arrangement is for illustrative purposes only and is not representative of the Utility Regulators preferred view. This arrangement can be modified to reflect the final position on ownership structure, which at all times shall comply with IME3 requirements. Ownership options are discussed further in section 6 of the paper, where participant views are requested.

The offshore substation in Figure 3 does not show any means of disconnecting the step-up transformers from the marine transmission cables. It is assumed some form of operational isolation will be necessary which could be a full circuit breaker or an isolating switch each with the necessary earth switching arrangements.

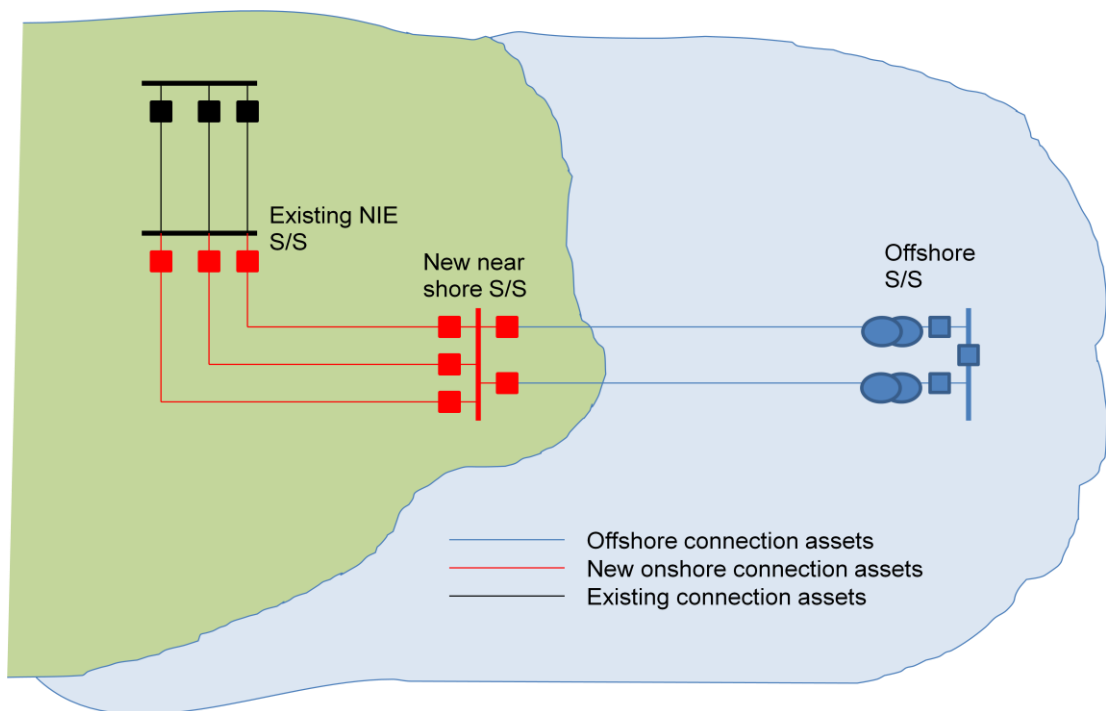


Figure 3 – Possible Radial Connection Variation 1, New Shore Side Substation

⁵ Central Electricity Generating Board Planning Department, Planning Memorandum PLM-SP-1, "Planning Standard of Security for the Connection of Generating Stations to the System", Issue 1, September 1975, and Northern Ireland Electricity plc Amendment Sheet Issue 2, 7 August 1992, "Connection of Generating Station Document (PLM-SP-1 Sept 1975).

Variation 1	Onshore Connection Assets	Offshore Connection Assets
Owner	TO	Developer
License	TO license	No transmission license required.
Responsibilities		
Design	TO	Developer
Build	TO	Developer
Maintain	TO	Developer
Operate	SO	Developer
Finance	Developer (with exception of deep reinforcements and system N-1 security requirements).	Developer

Table 1 – Variation 1, Developer retains ownership of connection assets - Summary of key areas of ownership, license and responsibilities

The advantages of this proposed option are:

- The developer is free to design the offshore connection assets to suit their wind farm or tidal generation scheme.

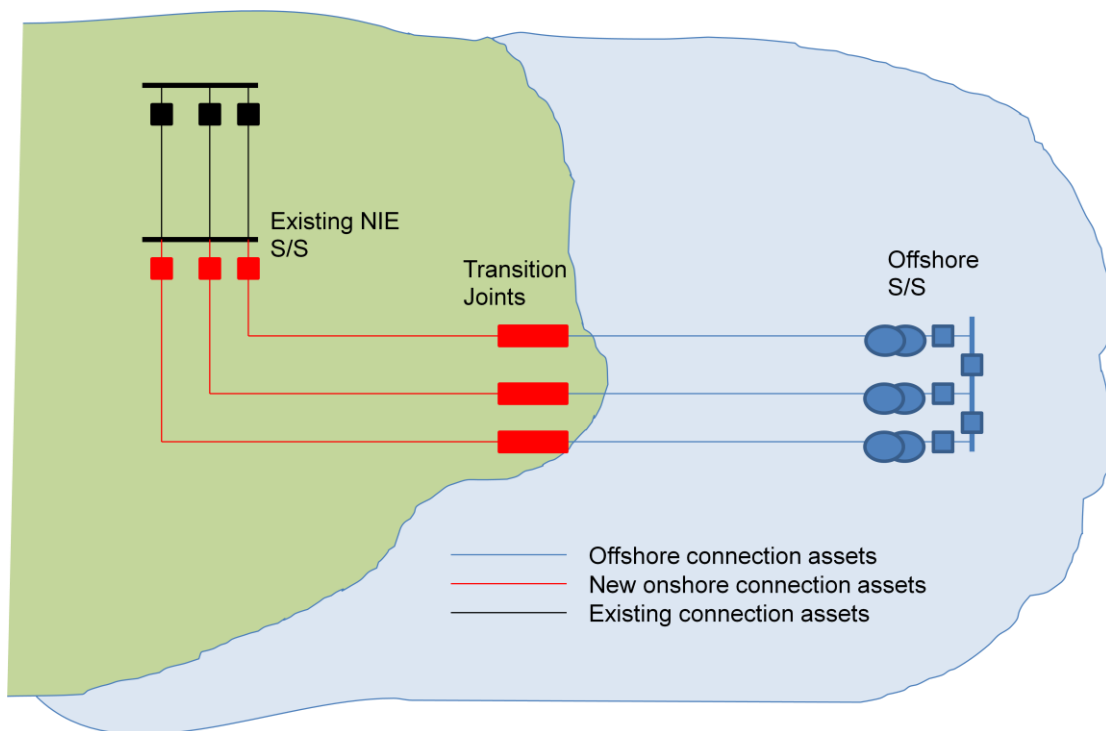
The disadvantages of this proposed option are:

- If the developer and TO agreed that the offshore connection assets should be adopted by a TO, the equipment would have to meet acceptable standards including the present Planning Memorandum PLM-SP-1 plus Amendment Sheet Issue 2⁶. This is discussed further in section 7.
- Potentially there may be no requirement for a new TO owned near shore substation, see variation 2.

5.4.2 Variation 2 - Transmission Radial Connection - TO Build

The TO near shore substation in variation 1 could be replaced with transition joints between the marine and onshore circuit cables and the substation effectively moved offshore, see Figure 4. Variation 2 is based on the TO building the transmission connection from an existing NIE onshore substation to the offshore substation. At present the connection design may necessitate an additional circuit running offshore funded by the developer to meet the N-1 security requirements of the present Planning Memorandum PLM-SP-1 plus Amendment Sheet Issue 2⁶. This requirement for future offshore connections is discussed further in Section 7.

The offshore substation in Figure 4 does not show any means of disconnecting the step-up transformers from the marine transmission cables. It is assumed some form of operational isolation will be necessary which could be a full circuit breaker or an isolating switch each with the necessary earth switching arrangements.



⁶ Central Electricity Generating Board Planning Department, Planning Memorandum PLM-SP-1, "Planning Standard of Security for the Connection of Generating Stations to the System", Issue 1, September 1975, and Northern Ireland Electricity plc Amendment Sheet Issue 2, 7 August 1992, "C0nnection of Generating Station Document (PLM-SP-1 Sept 1975).

Figure 4 – Possible Radial Connection Variation 2, Onshore Transition Joints

Variation 2 is based on the full transmission connection being designed and built by the existing TO in collaboration with the developer to ensure a fit for purpose connection. This would be necessary as some connection assets would be shared between the SO/TO and the generator e.g. communication fibre optics are normally built into the marine cable and required by both the generator and the SO/TO responsible for the transmission connection. Also, the offshore platform would include equipment for both parties, transmission equipment owned by the SO/TO and LV equipment owned by the generator.

The question of ownership boundaries on the offshore platform would also require to be agreed e.g. either party could own the offshore transformers. Also, either party, or a third party, could own and take responsibility for the offshore platform, foundations and ancillary plant.

Regardless of who takes ownership, both parties would require to collaborate on the design to ensure the offshore substation catered for both parties' equipment and fully supported operational requirements.

Regarding the step up transformers and LV switchgear there are a number of options:

1. The boundary with the SO/TO could be at the transformer HV terminals with the developer retaining ownership of all LV switchgear and the step up transformers. The SO/TO would own the HV cable terminations, busbars and any HV switchgear.
2. The boundary with the SO/TO could be at the step up transformer LV terminals with the developer owning the LV switchgear and the SO/TO owning the step up transformers, HV cable terminations, busbars and any HV switchgear.
3. The LV switchboard could be a split asset between the developer and the SO/TO with the SO/TO owning the transformer LV breakers and any LV bus-couplers or bus-section links. The SO/TO would also own the step up transformers, HV cable terminations, busbars and any HV switchgear.

Ownership boundary options 1 and 2 would require operational agreements to allow the SO control of isolating the transmission circuits and a mechanism for the generator operator to request the SO to isolate the transmission circuits. Interlocking may be required to prevent parallel operation of the transformers depending on the LV design. Protection trip interfaces would be required across the ownership boundaries for circuit isolation. The SO would require SCADA signals for the LV transformer breakers and any bus-coupler or busbar link switchgear.

Ownership boundary Option 3 would largely not require cross ownership boundary agreements.

The key areas of ownership, license and responsibilities associated with variation 2 are summarised in Table 2. Key points of this proposed option are:

1. The SO or TO would design and own the transmission assets and hence there would be compliance with IME3 unbundling requirements.
2. The majority of the connection assets will be paid up front by the developer. The exception being any deep reinforcements and the requirement for additional transmission system circuits to comply with the N-1 security standards. All circuits forming part of the connection assets would be paid for by the developer.
3. There is scope to remove the need for the near shore transmission substation of variation 1 and replace this with a set of cable transition joints.

Variation 2	Onshore Assets Connection	Offshore Assets Connection
Owner	SO or TO	Various Options Exist
License	SO or TO	SO or TO
Responsibilities		
Design	SO/TO	SO/TO in collaboration with the developer on the offshore substation design.
Build	TO	TO and developer, see note 1.
Maintain	TO	TO (excluding the offshore platform, foundations and auxiliary equipment and agreement on ownership of the LV switchgear and step-up transformers)
Operate	SO	SO
Finance	Developer (with exception of deep reinforcements and system N-1 security requirements).	Developer.

Table 2 – Variation 2, Summary of key areas of ownership, license and responsibilities

Note 1: To minimise procurement and construction risk associated with the offshore substation it may be preferable for the developer to take responsibility for the full offshore substation works including the platform, foundations, primary and secondary electrical equipment and all auxiliary equipment. If the developer is experienced in procuring offshore substations for wind farms and managing the interface risks it may be preferable for them to procure the offshore substation including the electrical plant rather than NIE. Based on the agreed boundaries

the relevant primary and secondary electrical plant, work shops, control rooms etc could be transferred to the SO/TO after completion.

5.4.3 **Variation 3 - Radial Connection - developer build**

Variation 3, see Figure 5 , is a combination of the approaches in option 1 and 2 where the developer designs and builds the full transmission connection. Under this variation it has been assumed that the connection assets would not require an N-1 security design and that the developer could determine the level of security they are prepared to pay for up to the connection point to the existing NIE substation.

The assumption above would change depending on what ownership structure is agreed. If the developer and TO agreed that it would be preferable for the connection assets to be adopted by the TO, and the design did not meet Planning Memorandum PLM-SP-1, the developer would have to consider that constraint payments could not be expected for outages on a connection that does not meet the security standards. This issue would also apply to connection variation 1 if the offshore assets were to be adopted by the TO. If it was decided to transfer the connection assets to the TO, the ownership boundaries and cross boundary operational agreements at the offshore substation would require to be addressed.

The offshore substation in Figure 5 does not show any means of disconnecting the step-up transformers from the marine transmission cables. It is assumed some form of operational isolation will be necessary which could be a full circuit breaker or an isolating switch both with the necessary earth switching arrangements.

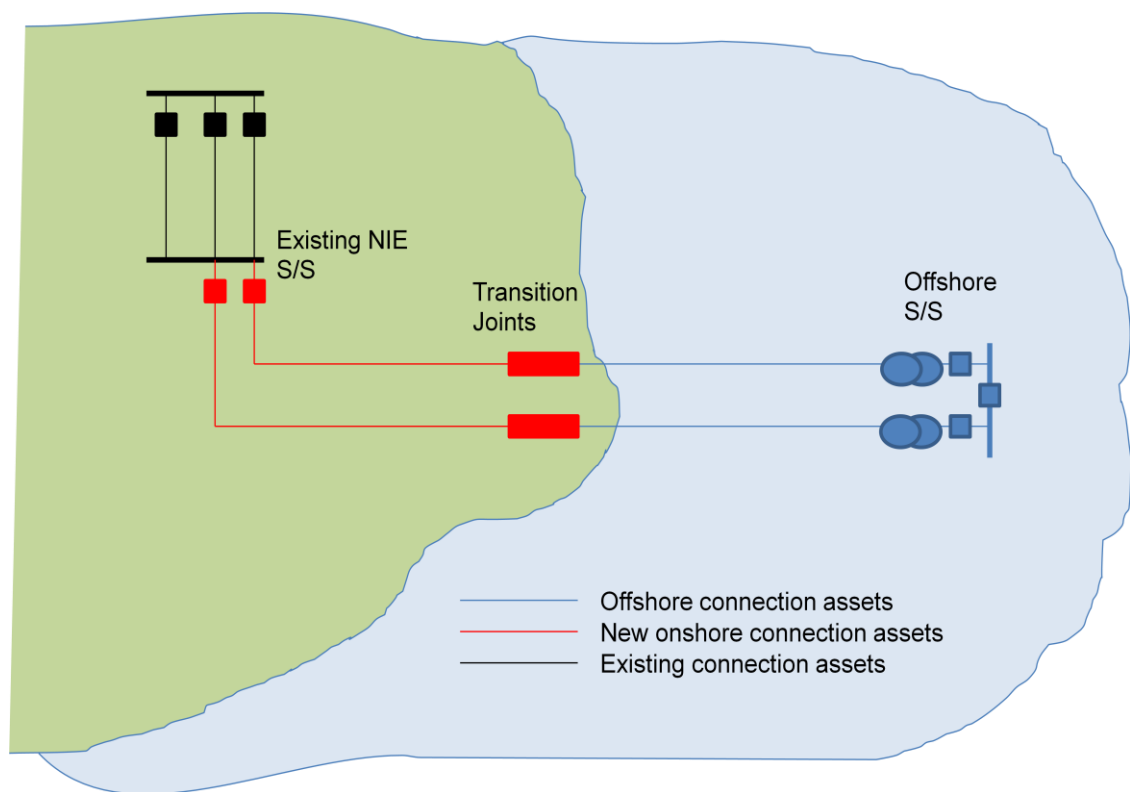


Figure 5 – Possible Radial Connection Variation 3, onshore transition joints with removal of the N-1 connection security requirement

As stated above the connection design would be at the discretion of the developer. The developer may decide that the connection design be close to the GB designs where compliance with the NETS SQSS⁷ is required for connections at 132 kV and above.

GB offshore wind farm transmission connections that comply with the NETS SQSS will be radial circuits. For connection capacities of 90 MW or greater, the security requirements are that the loss of potential generation capacity for a planned or unplanned loss of a connection circuit or circuit component, must not exceed 50% of the offshore grid entry point capacity (GEP). Hence for a typical design associated with a 600 MW wind farm (London Array Phase I and Gwynt y Mor are comparable) the connection would consist of two 50% transmission entry capacity (TEC) rated offshore substations each having two 25% TEC rated transformers stepping up to transmission voltage and each transformer having a cable circuit to an onshore substation. The NETS SQSS also requires the onshore substations to have a double bus bar arrangement. Typically these would have two busbar sections linked by a bus section breaker and for the 600 MW connection scenario here would have two export circuits connected to each onshore substation busbar section. Hence if an onshore substation busbar section is lost due to a busbar fault the maximum TEC/GEC capacity lost is 50%,

⁷ National Electricity Transmission System Security and Quality of Supply Standard

and the double bus bar arrangements allow full GEC/TEC to quickly be restored by reconfiguring the onshore substation.

The key areas of ownership, license and responsibilities associated with transmission connection variation 3 are summarised in Table 3 where ownership off assets is retained by the developer.

Variation 3	Onshore Assets Connection	Offshore Assets Connection
Owner	Developer.	Developer.
License	No transmission license required.	No transmission license required.
Responsibilities		
Design	Developer	Developer
Build	Developer	Developer
Maintain	Developer	Developer
Operate	Existing SO	Developer
Finance	Developer with the exception of any deep reinforcements	Developer

Table 3 – Variation 3, Ownership retained by developer - Summary of key areas of ownership, license and responsibilities

5.5 Radial Distribution Connection

This section presents two variations applicable to Tidal Zone 2 for radial distribution connections where landing power to shore at a transmission voltage is not the best solution:

- Variation One – Developer Build
- Variation Two – Onshore Cluster

5.5.1 Distribution Connection Variation 1 (Developer build)

Further to the discussion in section 5.2, development rights have been offered in Tidal Zone 2 for 2 generation schemes up to 100 MW each. There is a likelihood that there will be a need to land power from these schemes at distribution voltage levels even if ultimately the power has to be stepped up to a transmission voltage for export away from the local area. Distribution variation 1 considers that the local Distribution Network Operator (DNO) may be able to connect some schemes into the local distribution network. In this case the developer would design, build, operate, maintain and finance a distribution connection to an agreed point of connection (POC) on the DNO's network.

5.5.2 Distribution Connection Variation 2 (Onshore Cluster)

Section 5.2 touched on the concept of an onshore substation provided to collect power from a number of offshore generation schemes at a distribution voltage level such as 33 kV. This onshore cluster substation would step power up to transmission voltage for export away from the local area. This would require integration of the new substation into the transmission network including any transmission network reinforcement. Figure 6 outlines this distribution connection option.

The cluster substation could accommodate both onshore and offshore renewable generation and potentially provide a connection point at a transmission level from offshore generation if this was required, which leads back to the options outlined for offshore transmission connections already discussed.

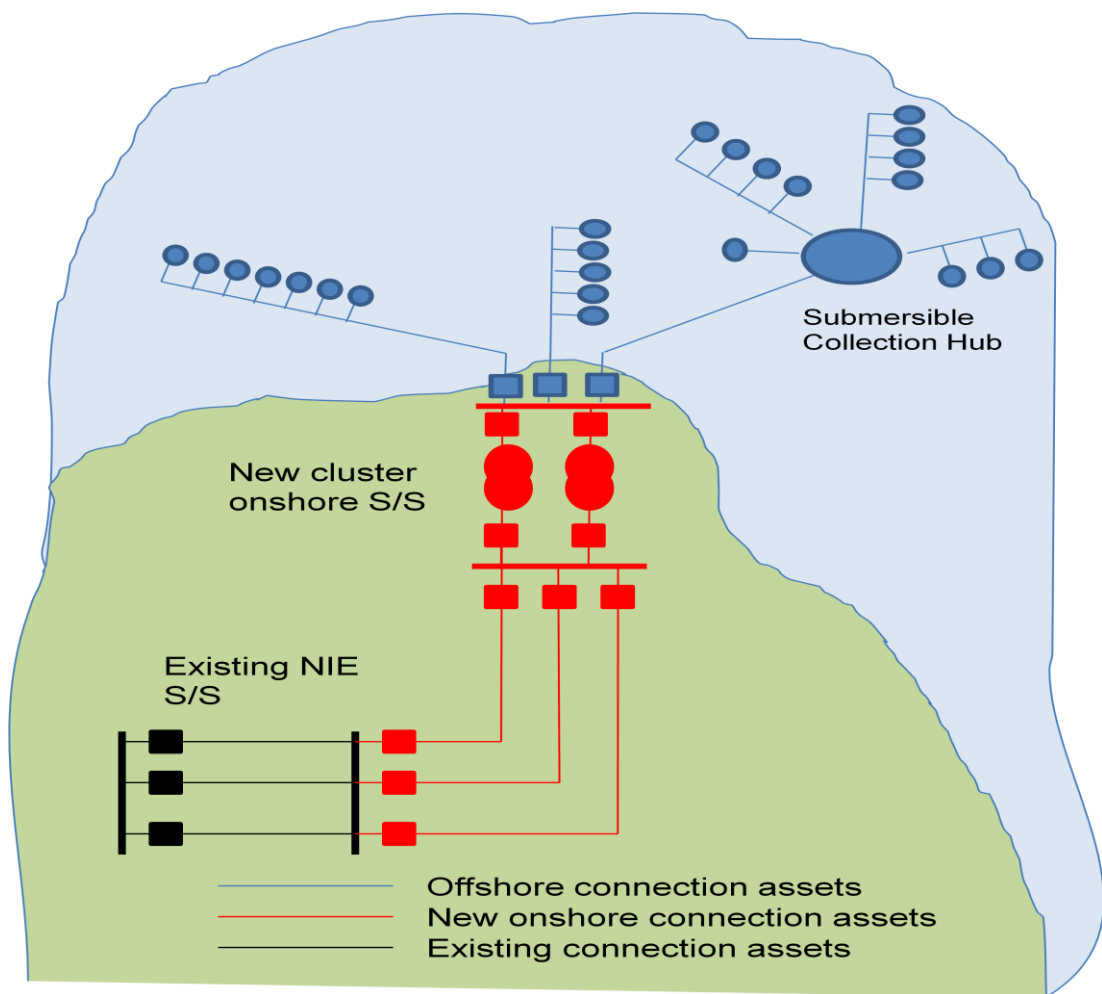


Figure 6 – Possible Onshore Cluster Substation Option for Offshore Distribution connections

It is assumed in Figure 6 that the power output from the turbines is stepped up to the distribution collection voltage either at the turbine or at a submersible collection hub.

If it was decided to move the cluster collection substation offshore then it would effectively become an offshore connection substation and be covered by the options discussed for offshore transmission substations covered earlier in this consultation paper.

The advantage of this option is that the developers could finance, build, own, operate and maintain the offshore distribution assets as IME3 rules would not apply to distribution.

The key areas of ownership, license and responsibilities associated with distribution connection variation 2 are summarised in Table 4.

Distribution Variation 2	Onshore Assets Connection	Offshore Assets Connection
Owner	DNO/TO	Developer
License	Existing TO and DNO	Developer generation license
Responsibilities		
Design	TO/DNO	Developer
Build	TO/DNO	Developer
Maintain	TO/DNO	Developer
Operate	TO/DNO	Developer
Finance	Developers/Consumers through regulatory price control until the full substation capacity is utilised by developers. Deep reinforcements and system N-1 security requirements financed by consumers.	Developer

Table 4 - Distribution Variation 2, Summary of key areas of ownership, license and responsibilities

5.6 Alternative Connection Arrangements

Radial connections to shore have been fully explored in sections 5.3 to 5.5 and in terms of connections to an individual wind farm or tidal scheme will provide the lowest cost impact solution to consumers. However, there may be alternative connection arrangements that provide other cost benefits e.g.

1. Provide reinforcement of the onshore transmission network in NI as well as connections to the potential offshore generation schemes in the Rathlin Island area and the coast off the SE of Northern Ireland.

2. Provide a connection for the potential offshore generation schemes in the Rathlin Island area and the coast off the SE of Northern Ireland with interconnection into the larger GB mainland electricity market.

5.6.1 **Offshore Network Providing Onshore Network Reinforcement and Offshore Connections**

The potential benefits of connecting offshore generation via an offshore network can apply where:

- there are numerous and large capacity wind farms in reasonable proximity. In this scenario the cost of an offshore network can be less than the total cost of all the point to point connections to shore. There may also be environmental benefits of reducing the number of cable landings compared with a point to point solution.
- it may be possible to provide onshore network reinforcement via a network to connect offshore generation.

The UK Round 3 zones off the coast of England is a case where National Grid has shown an offshore network would be more cost effective, reduce the number of cable landing sites and minimise onshore reinforcement requirements⁸.

The R3 zones off the east coast of England including East Anglia have commitment from developers for over 20 GW of offshore wind with some zone areas over 100 km from shore.

The offshore renewable zones off the coast of NI are expected to provide a more modest 800 MW of generation, with offshore substations relatively close to shore. With the limited number of likely radial connections to shore and the potential capacity at the likely connection points on the existing network the reduction in cable landing points is limited.

It is also not obvious that linking the offshore zone near Rathlin Island and the offshore zone off the SE coast of NI would provide beneficial network reinforcements compared with the radial connection options and medium/longer term onshore network reinforcements.

⁸ "Offshore Transmission Network Feasibility Study", National Grid and The Crown Estate, 26 September 2011, version 1, <http://www.nationalgrid.com/NR/rdonlyres/4FBE15A0-B244-4BEF-87DC-8D0B7D792EAE/49346/Part1MainBodysection191.pdf>

5.7 **Conclusion**

This section of the consultation has considered the physical connection arrangements for future offshore renewable electricity generation and plans for wider transmission system reinforcements to meet NI's 2020 target of 40% renewable electricity consumption. A number of transmission connection options have been outlined and views are requested regarding a number of points raised.

6 OWNERSHIP, RESPONSIBILITIES AND LICENSE ARRANGEMENTS.

Chapter Summary

This section considers the options for ownership, licensing and responsibilities for offshore transmission connection assets.

Questions to Respondents

Respondents are asked whether they feel it would be beneficial for the offshore generation transmission connection assets to be owned by the developer or alternatively by the TO, SO, or a third party via a tender process.

Should the present NI onshore transmission owner and license holder (NIE) be permitted to extend the onshore network offshore? This could be based on the present onshore regulatory regime with modifications where deemed necessary. This approach would imply that NIE would take ownership of transmission connection assets built by offshore renewable generation developers from the agreed offshore substation boundary with the generator to the onshore point of connection (POC).

Or should the developer have the responsibility to finance the design and build of the connection assets and the cost to maintain the offshore assets as part of the project?

UR would welcome comment and views on the ownership and license arrangements relating to offshore connections and are keen to seek alternative options that may be appropriate.

6.1 Introduction

In this section the Utility Regulator wishes to hear the views of participants with regard to their preferred connection ownership arrangement. The following section will cover the following;

- Requirements outlined in the European Third Energy package
- Potential options with regard to connection asset ownership

6.2 IME3 Unbundling

One of the areas covered by the EU Third Energy Package is unbundling, which involves, in the offshore transmission context, the separation of electricity generation and/or supply from transmission activities. The European Commission's ownership unbundling under the Third Energy package is a legal requirement that in broad terms means that a licensed electricity transmission operator can no longer exercise control⁹ of an electricity generation or supply company, and vice versa.

Independently operated networks are needed in order to promote competition in EU energy markets and increase security of supply, with energy prices being set by market forces, investments being in line with market needs and energy flowing to those that value it most. Well-functioning EU energy markets will also promote investments to bring to market the low-carbon technologies the EU needs to meet its carbon reduction targets.

The offshore electricity connection regulatory regime UR is developing through this consultation shall comply with EU IME3 unbundling requirements. The final decision paper will not consider any option that is felt to fall foul of IME3 requirements.

Should it be decided that the best course of action would be for the connection assets to be handed over to a third party then DETI may, through their proposed Offshore Renewable Energy Bill, need to introduce a legislative exemption to allow developers to test and commission a transmission asset without being in breach of IME requirements.

6.3 Ownership, Licenses and Responsibilities

⁹ "Control" is defined in the draft Electricity Directive of the Third Package as: "any rights, contracts or any other means which, either separately or in combination and having regard to the considerations of fact or law involved, confer the possibility of exercising decisive influence on an undertaking, in particular by: (a) ownership or the right to use all or part of the assets of an undertaking; (b) rights or contracts which confer decisive influence on the composition, voting or decisions of the organs of an undertaking".

The following section will identify a number of options with regards to the ownership of the connection assets. Participants are asked for their views on the options identified or any alternative option that they feel would be more beneficial.

Before identifying a number of ownership scenarios the Utility Regulator first looked at the current structures that have been adopted around Europe. What we found was that each member state has developed its own connection and ownership arrangements and that no one approach has been adopted. However, there does seem to be 3 main strands of ownership structure that have been adopted across the continent. Some states, such as Germany and Denmark, have gone for a regime whereby the TSO has ownership of the connection assets. Belgium has taken a different course, and has adopted a structure whereby the Generator owns and operates the connection assets. The UK has adopted a third alternative structure, known as an “OFTO” (offshore transmission owner) arrangement.

The OFTO regulatory regime is based on a competitive tendering process where companies bid for transmission connection licenses. Under the Transitional regime where assets built by the developer are transferred to an OFTO, the regulator sets the asset value, hence the bidders are competing on the basis of ongoing maintenance, finance costs, insurance and profit margins.

Taking into account these varying regimes in operation the Utility Regulator has proposed the following as potential ownership structures for offshore generators in the Northern Ireland.

Options for Ownership of Offshore Transmission Connection Assets

6.3.1 Option One – Developer Ownership of the Transmission Network Offshore.

The first possible ownership model would be for the offshore developer to own and maintain all the offshore connection assets.

Under this option the generator would design and build the transmission connection. The developer would then own and maintain the connection assets. This would be dependent on the connection asset being a single user radial connection transmission asset. Initial legal advice, sought by the Utility Regulator, has indicated this structure of ownership is fully compliant with IME3 unbundling requirements. The output of this review indicated that it is reasonable to take the view that offshore connection assets do not require a transmission licence.

If the connection asset were to be sold at a future date then they would no longer be connected to the NIE network and the electricity would no longer have a route to the network unless the new asset owners asked for a connection agreement. In this scenario the Utility Regulator would need to assess the asset connecting and see if it was exempt from licensing but as it would no longer be part of the generation asset

we cannot see how in this scenario, it would not need a transmission licence under current law.

Options two, three and four outline ownership arrangements whereby the offshore developer does not retain ownership of transmission connection assets after construction.

6.3.2 **Option Two – Extend the Present TO Transmission Network Offshore**

The second potential ownership model would be for NIE, the transmission network owner, to own the offshore connection assets. This ownership arrangement may require some modification to the existing NIE license.

The transmission connection assets could be designed and built by the existing TO, the developer or by both with the developer built assets being adopted by the existing TO. The TO would own and hold the license for the complete transmission connection, and be responsible for the on going maintenance of the connection. The SO would be responsible for the operation of the transmission assets. The connection design, ongoing maintenance regime and operational facilities would require to be agreed with the TO/SO and connection to the transmission network approved by the TO/SO. The connection assets would be financed by the developer noting the present rules on additional circuits to provide N-1 security and wider transmission reinforcements which are included in the TNUoS charge to all transmission network users. While normal practice is to charge for maintenance as a one of life time charge of 2% of the asset value, this may need to be modified as there is less certainty of ongoing costs associated with offshore transmission assets.

In terms of the connection assets to be adopted by the TO this would form an ownership boundary at the offshore substations between the retained developer assets and the TO adopted assets. A number of ownership boundaries could include the following:

1. The boundary with the TO could be at the offshore transformer HV terminals with the developer retaining ownership of all LV switchgear and the step up transformers. The TO would own the HV cable terminations, busbars and any HV switchgear.
2. The boundary with the TO could be at the step up transformer LV terminals with the developer owning the LV switchgear and the TO owning the step up transformers, HV cable terminations, busbars and any HV switchgear.
3. The LV switchboard could be a split asset between the developer and the TO with the TO owning the transformer LV breakers and any LV bus-couplers or bus-section links. The TO would also own the step up transformers, HV cable terminations, busbars and any HV switchgear.

The developer could retain ownership and ongoing maintenance and operational responsibility for the offshore structural assets and assets on the generator side of the connection boundary agreement including the topside platform, foundations, primary and secondary electrical equipment and all auxiliary equipment. The developer would also be expected to provide additional storage, work and operational rooms for the TO.

6.3.3 Option Three – The Present System Operator Takes Ownership

A third alternative ownership arrangement could be that the current System Operator (SONI) would take ownership of the offshore transmission connection assets as well as providing operation of the assets. This would require some modification to SONI's license and arrangements for the provision of maintenance of the assets.

To ensure consistency with the onshore system asset ownership and operation the ownership boundaries would be from the agreed boundary on the offshore substation discussed in option 1 and either the connection cable terminations at the near shore substation in Transmission Variation 1 or the transition joints between marine and onshore cables in Transmission variations 2 and 3 (see section 5).

6.3.4 Option Four Introduce New Licensed Offshore Transmission Owners

The final option proposed would be that a new offshore transmission owner could be introduced to own the offshore transmission connection assets. The new transmission owner would require being independent of any generation assets and fully comply with IME3 regulations.

This is the option that has been adopted in GB and has required considerable time and effort from the regulator and industry stakeholders to develop a new offshore regulatory regime.

The development of the GB offshore transmission regulatory regime has not yet been completed. All offshore transmission assets transferred to date to new Offshore Transmission Owners (OFTO) have been built by the wind farm developers and transferred under the "Transitional" offshore regulatory regime. The full offshore regulatory regime "Enduring" where the intention initially was for OFTO companies to design, build, maintain and finance new connections has still to be finalised and now contains an option for developers to build the transmission connection and then transfer to an OFTO.

The GB OFTO regulatory regime is based on a competitive tendering process where companies bid for transmission connection licenses. Under the Transitional regime where assets built by the developer are transferred to an OFTO, the regulator sets the asset value, hence the bidders are competing on the basis of ongoing maintenance, finance costs, insurance and profit margins.

The original intent of the Enduring regime where companies would bid for the design, build and ongoing maintenance, was to drive up innovation and drive down costs through competition. However, with the option for the developer to design and build the transmission connection and then transfer to an OFTO now included in the Enduring OFTO regime, it is not clear if the Enduring regime will deliver as originally intended.

The GB offshore regime arrangements included the extension of NGET's operational remit, as the Transmission Operator, to include the operation of the offshore transmission assets owned by others. NGET also has responsibility for the coordination of offshore connections and the associated onshore transmission network reinforcements. UR propose that both these functions in NI are performed by the existing SO.

6.4 Offshore connections at Distribution Voltages

IME3 unbundling rules do not apply to electricity distribution. In NI electricity distribution is deemed to be at voltages below 110kV.

Offshore generation connections at distribution level voltages are to be financed, designed, built, owned, maintained, operated and decommissioned by the developer/generator. The existing DNO will provide an onshore POC under present onshore regulations.

6.5 Conclusion

Respondents are asked to state their preferred transmission ownership arrangement or to propose an alternative arrangement that has not been considered in the consultation document, if they feel it would be more beneficial for all parties involved.

Respondents are also asked to state whether they agree with the proposed method for distribution connections.

7 **SYSTEM SECURITY, LEAST COST TECHNICALLY ACCEPTABLE (LCTA) CONNECTION DESIGN, COST ALLOCATION AND CHARGING ARRANGEMENTS.**

Chapter Summary

System Security, Least Cost Technically Acceptable (LCTA) connection design, Cost Allocation and Charging Arrangements touched on in sections 5 and 6 have been reviewed in greater detail. While present LCTA and cost allocation arrangements would remain suitable for offshore renewable generation connections a review of the transmission connection security requirements is currently being undertaken by NIE and SONI.

In terms of charging arrangements the SONI operation and maintenance (O&M) one off upfront charge over the lifetime of a connection, as stated in their Statement of Charges, should be reviewed to accommodate offshore transmission assets where SONI/NIE are to provide offshore connections.

7.1 Introduction

Physical connection arrangements for offshore generation have been discussed for both transmission voltages and distribution voltages in section 5. The questions of ownership, licensing and owner responsibilities are discussed in section 6. In both these sections the issues of system security, cost allocation and charging arrangements were touched on and are discussed further in this section.

7.2 System Security, LCTA, Cost Allocation and Charging Arrangements.

System Security

Transmission connection security arrangements presently require compliance with PLM-SP-1¹⁰ including Amendment Sheet Issue 2. The planning standard requires that:

1. It shall be possible to operate a generating station, whose maximum output does not exceed the two largest sets on the system, at maximum output during a prolonged outage of one of the connecting circuits. For larger stations it shall be possible to operate at maximum output with a prolonged outage of two of the connecting circuits.
2. Stations with a sent output capacity in excess of 550MW will normally be connected via at least four circuits.

The discussion in section 5.2 explains that the security standard may require N-1 circuits for the connection of the 600MW offshore wind zone recently awarded for development by The Crown Estate if this is connected as a single 600MW wind farm.

In Transmission Connection Variation 1 an additional circuit is required between the existing onshore substation and the new near shore POC substation, illustrated in Figure 3. The circuit would not be charged to the developer as a connection asset but would be treated as a system asset and impact the TUoS charge to all transmission system users. In transmission connection Variation 1 it is assumed that the offshore connection built by the developer does not require to comply with PLM-SP-1 and the level of security required from the POC to the offshore substation is at the discretion of the developer. This is also the assumption in transmission connection Variation 3 where the developer builds the connection to the POC at an existing onshore substation.

¹⁰ Central Electricity Generating Board Planning Department, Planning Memorandum PLM-SP-1, "Planning Standard of Security for the Connection of Generating Stations to the System", Issue 1, September 1975, and Northern Ireland Electricity plc Amendment Sheet Issue 2, 7 August 1992, "Connection of Generating Station Document (PLM-SP-1 Sept 1975).

Transmission connection Variation 2, where the present TO would design and build the connection from an existing onshore substation to a POC at the offshore substation, is based on compliance with PLM-SP-1.

In the case of transmission connection variations 1 and 3, the developer's transmission connection assets could be transferred to a new transmission license holder, possibly the existing TO. The question then arises as to whether the developer built transmission connection should comply with PLM-SP-1.

Potential options regarding security requirements would be:

1. To adopt the present PLM-SP-1 security requirements for the offshore Connection Asset and apply to developer built connections as well as TO built connection assets.
2. To adopt a less secure requirement to reduce connection costs for offshore generator connections and apply to developer built connections as well as TO built connection assets. Under this option the developer could opt for a more secure connection design if they are prepared to pay the incremental cost increase. The proposed minimum security level would be that for all offshore renewable generation stations of 90MW (arbitrary MW figure based on the present GB System Quality and Security Standard) capacity or above, a minimum of 50% of the pre-outage generation capacity connected must remain connected. This would include planned and unplanned single outages. For offshore renewable generation stations of 550MW (present PLM-SP-1 MW figure) -capacity and above, a minimum of 50% of the pre-outage generation capacity connected must remain connected for a single planned outage combined with a single unplanned outage.

Also for an onshore busbar fault a minimum of 50% of the pre-outage generation capacity connected must remain connected returning to 100% connected generation capacity in a short term period (time to allow reconfiguration of a double busbar substation arrangement).

This option would lead to a difference between offshore and onshore generation connection design requirements.

3. Maintain the present PLM-SP-1 standard and interpretation of this standard.

Amendment to PLM-SP-1 for offshore renewable generation connections is viewed as an import factor in developing the correct regulations for offshore renewable generation.

It should be noted that an NIE/SONI review of the Planning and Security standards is underway which shall review the planning and security standard PLM-SP-1 with regards to offshore generation. It is because of this that only some of the potential options have been put forward in this paper. It may be that the NIE/SONI consultation considers a different approach.

The Least Cost Technically Acceptable (LCTA) Connection Design.

The LCTA considers Connection Assets in a generation context are:

- those assets which are installed to enable the transfer of the Maximum Export Capacity (MEC) of the generator located at the POC, to the All-Island Transmission Networks; and
- those assets which are installed as a result of the generator's effect on fault current levels on the Transmission System, but does not include any assets installed at any location other than the POC to which the generator connects.

In deciding which assets are required to enable the transfers of the MEC, power flows other than those from the generator, are disregarded.

Assets which are not Connection Assets are System Assets and the costs of these assets are recovered through use of system charges.

In preparing a connection offer SONI presently will evaluate a number of design options before deciding on the preferred design for a new connection to the All-Island Transmission Networks. In doing so, there may be occasions where the preferred design is not the Least Cost Technically Acceptable ("LCTA") connection.

Where SONI does not proceed with the LCTA connection, the Applicant will only be required to pay for the estimated cost of the LCTA connection.

Where an Applicant requests a connection offer which is more expensive than the LCTA connection then the Applicant will be required to pay either the estimated or outturn cost of providing both the Connection Assets and additional System Assets, if any, required by the Applicant's preference. The UR sees no need to amend the present LCTA arrangements to accommodate the connection of offshore renewable generation.

Cost Allocation

Existing connection charging arrangements are suitable for extending to offshore renewable generation radial connections to a shore connection point.

This includes transmission voltage and distribution voltage connection options outlined in section 5.

The developer would pay in advance for all required **Connection Assets** including a charge for life time maintenance and decommissioning. New **System Assets** (deep reinforcements and N-1 security system assets) would be financed through the regulatory price control and charged to system users through use of system charges.

Connection Charging Arrangements

Existing connection charging arrangements are suitable for extending to offshore renewable generation radial connections to an onshore connection point. However, the following areas may require modification where SONI/NIE are requested to provide the offshore connection.

- Present SONI connection charges include an element to provide for the operation and maintenance (O&M) costs over the lifetime of the connection. The O&M charge is set at 2% of the Connection Asset value¹¹, increasing in real terms over the lifetime of the Connection Agreement, discounted back to a present value using the regulated rate of return. Where offshore transmission connections are provided by the present SO/TO or adopted from the developer the ongoing O&M charge rate in the SONI charging statement requires to be reviewed for offshore transmission assets. It may be the case that a defined charge for the offshore asset O&M cannot be defined for the charging statement, as the charge may vary between connections depending on a number of factors including marine surveillance requirements, insurances, spares requirements etc.
- Also, is there a requirement for the SONI charging statement to include cost estimates for offshore transmission assets as well as the onshore assets already presented? UR's minded to position is that the developer would finance and build the offshore connection assets to the onshore POC and retain these assets, hence, UR see no need to include cost estimates in the SONI charging statement.

7.3 Conclusion

System Security, LCTA, Cost Allocation and Charging Arrangements touched on in sections 5 and 6 have been reviewed in greater detail. While present LCTA and cost allocation arrangements would remain suitable for offshore renewable generation connections the following are proposed regarding connection security arrangements and SONI charging arrangements:

¹¹ SONI LTD Transmission Connection Charging Methodology Statement, 14 March 2008.

- As was pointed out in section 7.2 an NIE/SONI review of the Planning and Security standards is underway which shall review the planning and security standard PLM-SP-1 with regards to offshore generation. For the purposes of this paper three potential options have been outlined including retention of the existing standard. It is important to note that this does not mean that this will be adopted as part of the review.
- The SONI operation and maintenance (O&M) one off upfront charge covering the lifetime of a connection, stated in their Statement of Charges should be reviewed by SONI to accommodate offshore transmission asset O&M costs which may differ from onshore asset O&M costs in terms of percentage of the asset value.

8 CHANGES TO THE CONNECTION APPLICATION PROCESS AND THE NI CONNECTION QUEUE.

Chapter Summary

This section considers the existing and proposed connection application process for both transmission and distribution connections and the offshore renewable developer timing and commitment requirements for grid connections and associated deep transmission reinforcements. A number of issues are identified that are likely to be of significant concern to offshore renewable developers, including: the requirement to have planning permissions before a connection application can be progressed, the placement on the ITC analysis list based on having planning permissions, and potential delays to transmission network upgrades to increase their FAQ in the offer to match their MEC

Questions to Respondents

Where a connection to the transmission network is required, should the offshore developers apply for a connection and be added to the ITC analysis list **once** they have received development rights from The Crown Estate?

UR would like to seek views on this potential approach or any other alternative proposals.

What comparisons could/should be drawn with onshore application process for connections?

Are there areas where the process should be different to accommodate the more complex offshore analysis?

8.1 Introduction

In Northern Ireland (NI) any generator wishing to connect to the electricity transmission system must submit an application to SONI, the transmission System Operator (SO). Similarly a generator wishing to connect to the distribution system must submit an application to NIE, the Distribution System Operator (DSO).

It has become accepted practice that a Party applying for a connection must have planning permission in place for their generation scheme.

If there is inadequate capacity in the network to offer a firm connection then a non firm connection can be made before the associated transmission reinforcements are complete, the generator may be able to use the network to export, if the circumstances allow.

From the perspective of an offshore developer there are a number of key issues associated with the development of an offshore renewable generation scheme:

- The grid connection is a key element in determining the overall generation scheme design and physical layout, grid connection landing points and scheme capacity. Hence early information on suitable connection points to the network is required from the SO or DSO including commitment on capacity availability for the agreed connection point.
- Planning consents require to consider an outline design for the full generation scheme and the connection to shore. Typically in GB the onshore planning consents can take longer than the offshore consents, which are the Article 39 consent and the marine consents respectively.
- The grid connection requires being in place at least in part to deliver power from offshore for the first turbine to be commissioned. The grid connection capacity can be developed in stages to meet the offshore turbine installation and commissioning programme.
- Offshore generation development is expensive and the programme of turbine capacity coming online and the grid connection capacity being in place requires match to this. Importantly the development of firm connection capacity through network reinforcements requires to meet the installed generation capacity programme.
- The risk that firm connection capacity does not match the wind farm installation programme has series implications to the developer commencing with a scheme development.

A timely programme of grid connection and associated transmission network reinforcement to meet the firm connection requirements of the offshore generation development programme is a key factor. The connection application process must be adequate to provide developers with a timely assurance of connection arrangements

to meet their requirements while minimising the risk of stranded network reinforcements.

8.2 Proposed Changes to the Connection Application Process and the NI Connection Queue.

Transmission connection charging for generator connections in NI has been based on a shallow connection charging policy since the introduction of the SEM in November 2007¹². This is consistent with transmission generator connection charging in the ROI.

In October 2011, SONI ran a consultation process¹³ addressing the current and future availability of transmission network capacity, the possible output reduction levels on the generators and the timing of planned transmission reinforcements through the generator connection process. This paper contained proposals to implement an Incremental Transfer Capability (ITC) methodology to calculate a transmission Firm Access Quantity (FAQ) for each generator connecting to the transmission or distribution network (generation below 5MW connecting to the distribution network excluded). Where the FAQ is less than the generator's Maximum Export Capacity (MEC), transmission system upgrade works would be developed to facilitate a firm transmission access for the full MEC. FAQs for each generator would be re-assessed as upgrade works are completed and changes to FAQ advised on an annual basis.

The consultation paper further suggested that before being able to be added to the ITC list, connecting generators would need to have obtained planning permission, for the project build. It should be noted that at, under present arrangements NIE are responsible for getting Planning permission for the electrical infrastructure required to connect the project.

While the SONI proposals will provide potential generators with essential information, at an early stage in the connection process, on available transmission system access and also possible generator output reductions at each node on the NI transmission system, offshore developers are likely to have some concerns including.

- the requirement to have planning permissions before a connection application can be progressed;
- the placement on the ITC analysis list based on having planning permissions, and

¹² Single Electricity Market Committee, Transmission Connection Charging Statements: A Decision Paper, SEM-08-028, 14th March 2008.

¹³ SONI consultation document "Generator Connection Process ITC Methodology to determine FAQs & Generator Output Reductions Analysis", Consultation Paper, October 2011.

- potential delays to transmission network upgrades to increase their FAQ in the offer to match their requested MEC.

These concerns are set against the NI government target to achieving 40% renewable electricity consumption by 2020.

The requirement for developers to have planning permissions in place prior to their connection application being processed has historically been considered as establishing a reasonable level of commitment from the developer to complete the scheme development. Hence if the developer connection agreement leads to a possible requirement for deep transmission reinforcement works to increase the FAQ to meet the MEC, there is less risk that these deep reinforcements will become stranded assets due to the developer not completing the generation scheme.

However, offshore renewable generation schemes face a number of issues as discussed earlier in the introduction to this section that lead to a requirement to have a grid connection agreement in place early in the development process. Developers will require a connection agreement as part of the planning application process and not after planning permissions are received. The question may be, does the award of offshore development rights from the Crown Estate provide a sufficient level of commitment on the developer's part to ensure that the generation scheme will be completed if deep reinforcements are triggered.

8.3 Conclusion

Considering the existing and proposed connection application process for both transmission and distribution connections and the offshore renewable developer timing and commitment requirements for grid connections and associated deep transmission reinforcements, a number of issues are identified that are likely to be of significant concern to offshore renewable developers:

- the requirement to have planning permissions before a connection application can be progressed,
- the placement on the ITC analysis list based on having planning permissions in place,
- and potential delays to transmission network upgrades to increase their FAQ in the offer to match their requested MEC

One potential option would be to allow offshore developers to apply for a connection and be added to the ITC analysis list once they have development rights from The Crown Estate.

9 THE NEED FOR CHANGES TO THE GRID CODE.

Chapter Summary

UR has conducted a high level review of the Grid Code including the various codes within, Planning Code, Connection Conditions, Operating Code and others. While the Grid Code would largely accommodate offshore generator connections to either the transmission or distribution systems a number of areas are identified where amendment may be beneficial.

Questions to Respondents

Areas identified in the Grid Code where amendment may be suitable to accommodate the connection of offshore renewable generation are detailed in the following section. UR would welcome views or proposals for amendments to the Grid Code associated with not just the areas identified by UR but any other areas of the Grid Code where development may be required.

9.1 Introduction

UR is keen to receive views on amendments to the present Grid Code that may be required to accommodate offshore renewable generation connections. Consideration should be given to UR's minded to position on ownership and licensing discussed in section 7 where it is proposed that the developer would build the offshore connection assets and either retain the assets or transfer the assets to the TO (NIE) on completion, with the SO (SONI) operating the transmission connection assets.

9.2 The need for changes to the Grid Code.

The present SONI Grid Code¹⁴ includes:

- The **Planning Code** which provides generally for the supply of certain information by users in order that the planning and development of the transmission system may be undertaken.
- **Connection Conditions** which specify the minimum technical, design and certain operational criteria which must be complied with by users connected to or seeking connection with the transmission system.
- The **Operating Code** which is split into a number of sections one of which deals with the co-ordination of the outage planning process in respect of generating units and power station equipment, and outages of equipment on the transmission system and distribution system where relevant for construction, repair and maintenance (OC2).
- The **Scheduling and Dispatch Code** which includes the procedures and requirements in relation to frequency control (SCD3).
- The **Data Registration Code** which sets out a unified listing of all data required by the SO from users, and by users from the SO, under the Grid Code;
- **General Conditions** which are intended to ensure, so far as possible, that the various sections of the Grid Code work together and work in practice and which include provisions relating to the establishment of a Grid Code Review Panel and other provisions of a general nature.
- The **Metering Code**.

¹⁴ System Operator Northern Ireland, "SONI GRID CODE", 20 July 2012.

UR has identified a number of areas that may require addressing within the Grid Code to accommodate offshore renewable generator connections including:

- Additions to the **Glossary of Definitions (GD)** to cover offshore related definitions e.g. Offshore Waters, Offshore Generating Unit, Offshore Grid Entry Point, Offshore Platform, Offshore Power Park Module etc.
- Reference to standards or best practice for the provision of offshore transmission assets that are fit for the offshore environment they will be installed in. Possible amendment to CC6.2 Plant & Apparatus.
- Dynamic VAr compensation equipment and harmonic filtering equipment can be major cost items for a grid connection to a large offshore wind farm where the cost should be met by the developer. While the present Connection Code addresses these issues UR would be happy to receive views on any perceived power factor, voltage control and harmonic distortion issues that may need clarified and the Connection Code amended.
- The TO/SO may share offshore substation facilities with the Generator, each will have electrical equipment located on the offshore substation. UR's minded to position is that the generator will own the offshore platform. The present Operational Code (OC6) allows for the establishment of safety responsibilities for work on or near transmission equipment. This includes the use of local safety procedures controlled by the SO/TO or the Generator. UR's view is that safety procedures for offshore transmission operations and maintenance can be established through local safety procedures established by the Generator, TO and SO without amendment of the Operational Code, however, UR would be keen to receive the views of other stakeholders.

It is noted that technical requirements and all changes required to Grid Code will be handled through the normal Grid Code modification processes.

9.3 **Conclusion**

UR has conducted a high level review of the Grid Code including the various codes within, Planning Code, Connection Conditions, Operating Code and others. While the Grid Code would largely accommodate offshore generator connections to either the transmission or distribution systems a number of areas are identified where amendment may be beneficial.

It is important to note that all changes to the Grid Code will be handled through the normal Grid Code modification processes that is carried out by SONI.

10 WHAT HAPPENS NEXT

Responses to this consultation paper are to be received by 30 May 2013. After this date UR will review all consultation responses. Based on this review UR will prepare a final decision paper.

A final decision paper will set out the key principles and surrounding issues regarding offshore connection arrangements, which will enable further work to be taken forward in putting the appropriate arrangements in place.

The final paper will contain decisions on the key principles and surrounding issues regarding offshore connection arrangements. This will enable further work to be taken forward to put in place arrangements by UR, the Systems Operator for Northern Ireland (SONI), Northern Ireland Electricity (NIE), and the offshore renewable project developers.

UTILITY REGULATOR would expect to publish the final decisions paper during Summer/Autumn 2013.