Consolidated Environmental Statement Addendum

Volume 2
Main Text
June 2015

SONI

Tyrone Cavan Interconnector

The current. The future.

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EU TEN-E Initiative

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*Due to its size the North-South 400 kV Interconnection Development EIS is provided electronically only. Paper copies are available for purchase, please contact SONI for details:

Transmission Projects, SONI, 12 Manse Road, Belfast, BT6 9RT

Website: www.soni.ltd.uk

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Chapter 1 Introduction



Main Text Volume 2

June 2015

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SONI
Tyrone Cavan Interconnector
The current. The future.

1 Introduction

1.1 Purpose of this Addendum

1. System Operator for Northern Ireland (SONI) is seeking consent from the Northern Ireland Department of the Environment (DOE) to construct a 400,000 volt (400 kV) overhead line in Counties Tyrone and Armagh, and an associated 400/275 kV substation in the townland of Turleenan (near Moy), County Tyrone. The overhead line will run for a distance of approximately 34km to the jurisdictional border with the Republic of Ireland border. The proposed overhead line, the substation and associated development are referred to in this document as the "Tyrone – Cavan Interconnector".

2. The Tyrone - Cavan Interconnector forms part of a major cross-border transmission infrastructure development extending for a total distance of approximately 138km from the proposed substation at Turleenan to an existing substation at Woodland, County Meath ("the proposed interconnector"). This comprises a complete new transmission link between the existing 275 kV transmission system in Northern Ireland and the existing 400 kV transmission system in the Republic of Ireland.

3. The assessment of the Tyrone - Cavan Interconnector has taken place over a number of years and several documents have been previously published as part of this process, including the original Environmental Statement published in 2009 and its addenda (2011).

4. In 2012, the Planning Appeals Commission (PAC) requested a single overall document which combined (or consolidated) the previously published environmental assessment documents.

5. The Consolidated ES (published in 2013) incorporates the findings of the previously published documents as requested by the PAC, but also outlines and assesses new and/or updated information of relevance to the Tyrone - Cavan Interconnector. This includes updates to the proposed design, changes in policy and legislation, results of further environmental surveys, including in particular those in relation to temporary works associated with construction of the Tyrone - Cavan Interconnector, such that the Consolidated ES provides an overall assessment of the likely significant effects of the Tyrone - Cavan Interconnector. The Consolidated ES therefore supersedes and replaces the previously published ES and addenda.

6. It should also be noted that the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 1999 continue to apply as modified and that, "The Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2015" have been introduced which revoke the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2012. Regulation 45 (2) of the 2015 Regulations states that where an application is to be treated as if it were an application to which Section 26 applies, "then where that application is also an EIA application under the 2012 Regulations, anything done by or in relation to the Department in connection with any of its functions under the 2012 Regulations shall be treated as if it had been done by the Department in connection with its function under these Regulations". It can be noted that the 2009 Overhead Line Application will continue to be assessed under the 1999 Regulations and the 2012 Associated Works application will be assessed under the 2015 Regulations.

7. The purpose of this report (the "Consolidated ES Addendum") is to provide additional environmental information in support of the planning applications for the Tyrone - Cavan Interconnector. The Consolidated ES Addendum is intended to be read together with the Consolidated ES as it provides additional information and also supersedes some of the information previously provided.

8. Table 1.1 highlights how the chapters of this Addendum interact with those of the Consolidated ES.

Table 1.1: Status of Impact Assessment Chapters

Consolidated ES (2013)	Consolidated ES Addendum (2015)
Chapter 1 Introduction	
Chapter 2 Need	**Addendum Chapter 3 Need provides an update on Policy Need and supersedes the Technical Need assessment section of the Consolidated ES.**
Chapter 3 Planning and Development	**Addendum Chapter 4 Planning and Development provides supplemental information.**
Chapter 4 Alternatives	**Addendum Chapter 10 Technology Alternatives provides supplemental information.**
Chapter 5 Proposed Development	**Addendum Chapter 1 Introduction provides supplemental information.**
Chapter 6 – Scoping and Consultation	**Addendum Chapter 9 Air Quality and Climate provides supplemental information.**
Chapter 7 – Electric and Magnetic Fields	**Addendum Chapter 1 Introduction provides supplemental information.**
Chapter 8 – Water Environment	
Chapter 9 – Geology, Soils and Groundwater	
Chapter 10 – Ecology	**Addendum Chapter 8 Ecology provides supplemental information.**
Chapter 11 – Noise	**Addendum Chapter 11 provides supplemental information.**
Chapter 12 – Cultural Heritage	
Chapter 13 – Landscape and Visual	**Addendum Chapter 1 Introduction provides supplemental information.**
Chapter 14 – Community Amenity and Land Use	
Chapter 15 – Socio- Economics	
Chapter 16 – Telecommunications and Aviation Assets	
Chapter 17 – Flood Risk Assessment	
Chapter 18 – Transport*	**Addendum Chapter 7 Haulage Route Assessment provides supplemental information.**
Chapter 19 – Cumulative and interrelationship of impacts	**Addendum Chapter 5 Cumulative and Interrelationship of Impacts supersedes the cumulative chapter in the Consolidated ES.** **Addendum Chapter 2 Joint Environmental Report provides supplemental information.**
Chapter 20 – Transboundary impacts	**Addendum Chapter 6 Transboundary Impacts supersedes the transboundary chapter in the Consolidated ES.** **Addendum Chapter 2 Joint Environmental Report provides supplemental information.**
Chapter 21 – Conclusion	

1.2 Definition of Terms

9. As the project has developed and evolved over a number of years, the names used to describe the proposed interconnector have also developed. For clarity, the following terms have been used:

- **The proposed interconnector:** The overall project from Turleenan to Woodland (i.e. both the SONI and EirGrid sections), including all proposed works;
- **The Tyrone – Cavan Interconnector:** That portion of the proposed interconnector located in Northern Ireland being proposed by SONI; and,
- **The North-South 400 kV Interconnection Development:** That portion of the proposed interconnector located in the Republic of Ireland being proposed by EirGrid, and which comprises an application for Statutory Approval to the relevant authority in Ireland, An Bord Pleanála.

1.3 Contents of this Addendum

10. The Consolidated ES Addendum is split into four volumes:

- Volume 1 –the Non-Technical Summary;
- Volume 2 – the Main Text ;
- Volume 3 – the Appendices; and
- Volume 4 – the Figures.

11. The Consolidated ES Addendum Volume 2 (Main Text) contains the following Chapters:

- **Chapter 1 Introduction** – an overview of the report and a description of the EirGrid section of the proposed interconnector (North-South 400 kV Interconnection Development) being concurrently proposed by EirGrid. An overview of updates surrounding the project are also included on the following topics: Do Nothing Scenario and Decommissioning, New Planning Applications in the area of the Tyrone - Cavan Interconnector, two alternative access tracks, and a minor design change to proposed Tower 102;
- **Chapter 2 Joint Environmental Report**– a joint report for the proposed interconnector in-line with recent European Commission guidance;
- **Chapter 3 Need –** an overview of relevant European, national and regional policy need for the project issued since the publication of the Consolidated ES and an assessment of the technical need for the proposed interconnector**;**
- **Chapter 4 Planning and Development Context** – an overview chapter on relevant planning and policy issued since the publication of the Consolidated ES;
- **Chapter 5 Cumulative Impact Assessment** – an updated cumulative impact assessment;
- **Chapter 6 Transboundary Impact Assessment** – an updated transboundary impact assessment;
- **Chapter 7 Haulage Route Assessment** – an assessment of the haulage route for the transformers required for the proposed Turleenan substation;
- **Chapter 8 Ecology** – an updated assessment on the ecological impacts of the Tyrone - Cavan Interconnector following updates to guidance and further ecological surveys undertaken in summer 2013;
- **Chapter 9 Air Quality and Climate** – an assessment of the air and climate impacts of the

Tyrone – Cavan Interconnector;

- **Chapter 10 Technology Alternatives** – an assessment of the Technology Alternatives for the proposed interconnector and the technical potential for partial undergrounding of the proposed interconnector and, in response to a request from the planning authorities in the Republic of Ireland to EirGrid, an assessment of the potential for partial undergrounding to mitigate significant landscape impacts on landscape demesne landscapes was undertaken; and,
- **Chapter 11 Noise Assessment** – since the publication of the Consolidated ES, two noise standards have been revised and this chapter updates the assessment in light of these changes;
- **Chapter 12 Erratum** – a chapter correcting typographical errors in the Consolidated ES.

1.4 Change of Applicant in Northern Ireland

12. EirGrid and SONI are jointly planning a major cross-border electricity transmission development between the existing transmission networks of the Republic of Ireland and Northern Ireland. The planning of that portion of the proposed interconnector within Northern Ireland was originally undertaken by Northern Ireland Electricity (NIE). However, NIE was required by the European Commission[1] to transfer its investment planning function (the "Planning Function") to SONI. The SONI transmission system operator licence (the "Licence") was amended on 28th March 2014 to take account of the transfer of the Planning Function following a consultation process by the Utility Regulator. The Licence amendments took effect on 30th April 2014. Accordingly, responsibility for the pursuance of the planning applications in respect of the proposed interconnector within Northern Ireland has been transferred from NIE to SONI. SONI is therefore now the Applicant for the Tyrone – Cavan Interconnector, and DOE has been notified accordingly.

13. Following the transfer of its Planning Function to SONI, NIE will continue to be responsible for the construction, ownership and maintenance of the transmission system in Northern Ireland. Subject to planning consents being obtained for the Tyrone – Cavan interconnector, NIE will be responsible for its construction, in accordance with said consents.

14. In summary, any reference to NIE within the application for approval specifically regarding the planning and consenting of the proposed interconnector should be understood as now referring to SONI in the context of its newly acquired statutory responsibility for the pursuance of the planning applications in respect of the proposed interconnector.

15. In accordance with its statutory functions prior to the transfer of the planning function to SONI, certain references to NIE remain in respect of the proposed interconnector.

1.5 Status of EirGrid Application

16. The Tyrone - Cavan Interconnector forms part of a major cross-border transmission infrastructure development extending for a total distance of approximately 138km from the proposed substation at Turleenan to an existing substation at Woodland, County Meath ("the proposed interconnector"). This comprises a complete new transmission link between the existing 275 kV transmission system in Northern Ireland and the existing 400 kV transmission system in the Republic of Ireland.

[1] In accordance with European Commission Decision of 12th April 2013 made pursuant to Article 3(1) of Regulation (EC) No 714/2009 and Article 10(6) of Directive 2009/72/EC - United Kingdom (Northern Ireland) - SONI/NIE.

17. The Tyrone - Cavan Interconnector is now promoted by SONI and its consultants and has been closely coordinated with parallel activity undertaken by EirGrid and its consultants within the Republic of Ireland.

18. In June 2015, EirGrid submitted a planning application, accompanied by an Environmental Impact Statement (EIS) and Natura Impact Statement for the portion of the proposed interconnector in the Republic of Ireland. The EIS has been included in Appendix 1.1 of this Consolidated ES Addendum and is available at www.eirgrid.com.

19. The route of the proposed interconnector (both SONI and EirGrid sections) is shown in Figure 1.1 of this Consolidated ES Addendum.

20. The publication of the EirGrid application has allowed SONI and EirGrid to complete the cumulative and transboundary assessments for the proposed interconnector. Section 5 (Cumulative Impact Assessment) and Section 6 (Transboundary Impact Assessment) of this report are updates to the corresponding chapters (Chapters 19 and 20) of the published Consolidated ES (May 2013).

1.6 Do Nothing Scenario

21. The Do Nothing scenario is the scenario within the existing environment where the Tyrone – Cavan Interconnector is not constructed. In this case, under the Do Nothing scenario, the land upon which such development is proposed to occur – primarily agricultural land - would remain unchanged, unless developed for some separate purpose. As a consequence, the environmental impacts identified in the assessment of the Tyrone – Cavan Interconnector, positive and negative, would not occur.

22. Under the Do Nothing scenario, the interrelated strategic needs for additional interconnection between the two electricity transmission systems on the island of Ireland would not be met. Doing nothing would fail to address the need to improve the efficiency of the electricity market, as required by existing European Directives, and would impede the realisation of the respective government policies to increase renewable energy generation. It would not deliver the additional electricity transfer capacity needed to deliver improvements in the security of electricity supply within the island of Ireland in general. Nor would it ensure that Northern Ireland, in particular, is able to avoid future shortfalls in electricity supply.

23. In the case of the Do Nothing scenario, there would continue to be changes in the study area as a result of on-going land management and development. The study area is heavily influenced by human activities and will likely continue to be so. It is likely that most of the study area would continue to be managed intensively for agriculture with ongoing development in the form of agricultural and residential buildings with some industrial and energy projects (such as single wind turbines). Possible changes could include further land drainage, habitat devaluation and loss, potential impacts in terms of landscape and visual effects. Improvements in the form of habitat restoration and afforestation could also occur. Such changes would not be influenced by the presence or absence of the Tyrone - Cavan Interconnector and would be subject to any applicable planning and consent controls.

24. Given that the limited extent of the existing electricity interconnection between the transmission systems of Northern Ireland and the Republic of Ireland is insufficient to achieve the key objectives referred to above, the Do Nothing alternative is not acceptable, and SONI (along with EirGrid) has rejected it.

1.7 Decommissioning

25. The Tyrone - Cavan Interconnector will become a permanent part of the strategically important electrical transmission grid infrastructure network. Following construction, its ongoing operation will be facilitated by routine maintenance, refurbishment and replacement of redundant equipment to ensure a permanent transmission infrastructure. Accordingly, SONI and NIE have no plans for the decommissioning of the overhead line, towers or substation.

26. The lifespan of the Tyrone - Cavan Interconnector is anticipated to be extended beyond its 50 - 80 year design life, if required, depending on its condition and refurbishments and depending on the transmission network requirements.

27. In the unlikely event that its useful life has expired and it is to be removed, much of the material of the overhead line, towers and substation will be taken for recycling. Similar access will be required as for the construction phase as outlined in the Consolidated ES.

28. Fittings such as spacers and dampers would be removed from the conductors. The conductors would be winched onto drums in a reverse stringing process to that described for construction in the Consolidated ES. The fittings would be removed from the towers and lowered to the ground.

29. The towers would be dismantled, with sections disconnected for removal from site. Typically the foundations would be removed to approximately 1m deep and subsoil and topsoil reinstated.

30. Demolition works would be required at the substation and the aim of the process would be to return the area to agricultural use. It is likely that any landscape planting would remain in situ with the 'hard standing areas' removed and returned to its former use.

31. The decommissioning of the Tyrone - Cavan Interconnector, if it was to occur, would be undertaken at an unknown time in the future. However, the effects of decommissioning would be temporary and of a similar scale to or less than the construction phase, as described and assessed in the Consolidated ES. Similar mitigation measures as described for the construction stage in the Consolidated ES should be again implemented to ensure the minimisation or elimination of any environmental impacts.

1.8 Developments in the Area of the Tyrone – Cavan Interconnector

1.8.1 Overview

32. Since the publication of the Consolidated ES, various additional planning applications have been submitted and consented as part of the normal development of the area. The DOE has been liaised with to obtain accurate and up to date information but this may change while the planning applications for the Tyrone – Cavan Interconnector are determined.

1.8.2 Visual impact Assessment

33. Since the assessment within the Consolidated ES was undertaken, a number of residential dwelling planning applications have been consented. These dwellings represent additional visual receptors and have been assessed in Appendix 1.2 of this report.

34. As explained in section 13.6.2.2 of Chapter 13 of the Consolidated ES, individual dwellings identified within the detailed study area of 500m either side of the line route have been assessed for potential effects as a result of the Tyrone - Cavan Interconnector during construction and at Year 1 and Year 15.

35. Eight additional dwellings have been determined to be consented or new build dwellings as of March 2015 within the study area. Five new residential receptors have been assessed as having residual Moderate adverse effects or above arising from the Tyrone – Cavan Interconnector. These are: A26, A27, G33a, G34 and E43+ (see Appendix 1.2 and associated figures).

36. The following two planning permissions O/2011/0184/F and O/2010/0824/O are highlighted in particular in the text below due to their proximity to the line route. Planning Permission O/2011/0184/F, if constructed, would become the closest dwelling to the overhead line, and so additional text on the potential impacts to the dwelling is provided in the following text.

1.8.3 Planning Permission O/2011/0184/F

1.8.3.1 Overview

37. Planning permission O/2011/0184/F (Bracknagh Road, near to Tower 47), if constructed, would represent the closest dwelling to the centreline of the overhead line at 49m. Previously, the Consolidated ES had identified that the previous closest dwelling was 54m distant, which was correct at the time of its writing.

38. In addition, the consented application O/2011/0184/F would be 80m from the base of Tower 47, which will be the closest dwelling to a proposed tower base. The Consolidated ES identified that the previous closest dwelling to a tower was 85m from the base of Tower 25, which was correct at the time of its writing.

39. The dwelling authorised by Permission O/2011/0184/F has been assessed in terms of visual impacts in Appendix 1.2 of this Addendum. It has been assessed that the dwelling, if constructed, would be subject to a major adverse visual impact during construction and operation.

1.8.3.2 EMF Assessment

40. Section 7.3.5.1 of the Consolidated ES (Volume 2, page 188) considers the issue of nearby dwellings in the context of EMFs. It explains:

> *"The assessment of compliance is not dependent on the exact location of the nearest existing residential property* (dwelling) *to the line, or the nearest putative property* (dwelling) *already granted planning permission, or the nearest property that might in future be granted planning permission, because the field from the line is compliant everywhere, not just compliant outside some specified distance."*

41. Thus, this consent of planning permission does not have any effect on the assessment of compliance of the proposed overhead line with the relevant EMF requirements.

42. Paragraphs 100 and 247 of Chapter 7 of the Consolidated ES (Volume 2, Pages 189 and 211 respectively) both make reference to the closest distance of any dwelling at the time of assessment, being 54m. The dwelling authorised by Permission O/2011/0184/F will be 49m from the centreline of the overhead line if constructed. The assessment within the Consolidated ES (Chapter 7) and in these paragraphs specifically, is that fields at a distance from the overhead line will drop considerably. As can be seen from Illustrations 7.2 and 7.3 of the Consolidated ES, this remains true whether the exact value is 49m, 54m, or any other similar value. Therefore the Tyrone – Cavan Interconnector remains compliant with Government policy and with relevant exposure guidelines[2].

1.8.3.3 Noise Assessment

43. The Noise assessment of the Consolidated ES (Chapter 11) had undertaken an assessment of the impacts on the nearest dwelling at that time (54m from centreline and 85m from a tower base). The assessment has been updated below to take account of consented planning application O/2011/0184/F (49m from centreline and 80m from a tower base).

Overhead Line Corona Noise and Corona Discharge

44. Corona noise is occasionally found on transmission lines where higher voltages exist. Most modern transmission lines and substations are designed to reduce the magnitude of the electric field surrounding the line conductors below the air breakdown value. Occasionally a small sharp point can

[2] International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998 in the terms of the 1999 EU Recommendation

be found on a line or on nearby hardware that will result in a corona discharge. Such discharges are often more active during the increased humidity conditions provided by fog or light rain. Water drops impinging or collecting on the conductors produce a large number of corona discharges, each of them creating a burst of noise. In dry conditions, the conductors usually operate below the corona inception level, and less corona sources are present.

45. Corona noise comprises two sound components: one is irregular (random crackling noise) sound, and the other is the pure sound (hum noise) of buzzing. The random sound has a wide frequency band because the sounds caused by corona discharge occur randomly. The corona hum noise results from the electric field surrounding the conductors. .

46. The level of operational noise from overhead lines will vary depending upon the environmental conditions, the locality and a number of other factors including the distance to ground and voltage. The noise experienced from this discharge is typically a short burst of random 'crackling'. Corona discharge typically occurs where a sharp point or edge is present, either on the conductor or the tower coupling. This is minimised by careful handling of the overhead line conductor during the stringing process so that sharp points are not created along the conductor.

Guidelines on Internal Environments

47. BS8233:1999 Section 7.6.1 contains guidelines for residential dwellings within a noise level range such that the lower value is 'good' and the upper value is 'reasonable'. The target criteria for living rooms recognise that these rooms may be used for resting or sleeping, and there is no distinction between day and night-time use. The criteria presented are:

- Living Rooms = 30-40 dB L_{Aeq}
- Bedrooms = 30-35 dB L_{Aeq}

48. Considering fair weather and an external level of approximately 40.5 dB (A) at any close noise sensitive dwelling as a worst-case scenario (this is the predicted value for the closest dwelling being, 49 metres distance from the centreline of overhead line and within the 'fair weather range' as shown in Illustration 11B), and 15 dB attenuation due to an open window (as per the WHO Guidelines), the predicted internal noise level would be circa 25-26 dB(A). This is below the BS 8233 guidelines levels of between 30-35 dB(A) for bedrooms and below 30-40 dB(A) for Living Rooms.

49. It is useful to consider the Electric Power Research Institute (EPRI) predicted rain noise levels (Illustration 11.2, Volume 2 of the Consolidated ES, page 384) with regard to BS8233. Considering a second scenario with the same distance (49m) and a EPRI rainfall L50 level of circa 48 dB (A) the internal noise level will be 33 dB(A) (considering 15 dB through an open window), within the BS 8233 guidelines levels of between 30-35 dB(A) for bedrooms and within 30-40(A) dB for Living Rooms.

50. Thus it can be seen that the internal noise levels within a dwelling, considering the presence of fair and wet weather will be within the BS8233 recommendations. During periods of rainfall windows will generally remain closed which will provide further attenuation of noise levels and prevent noise break-in. Rain fall noise would also help to mask any occasional overhead line corona noise at nearby dwellings.

Guidelines on External Environments

51. The World Health Organization (WHO) Guidelines for Community Noise document provides guideline acceptable noise levels for external spaces. Section 4.2.7 of the WHO Guidelines states that "During the daytime, few people are seriously annoyed by activities with L_{Aeq} levels below 55 dB; or moderately annoyed with LAeq levels below 50 dB." The WHO Guidelines go on to state that "Sound pressure levels during the evening and night should be 5–10 dB lower than during the day."" Section 4.3.1 of the WHO Guidelines states that 'To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50 dB L_{Aeq}.'

52. It is the consensus view among experts on annoyance studies that 50-55dBL_{Aeq} daytime is the onset at which these health effects such as annoyance may be observed. In practice many residential dwellings

are subject to much higher outdoor daytime noise levels than 50-55dBL_{AeqT} due to road traffic, railways or industry.

53. The predicted free field external noise levels for the continuous noise emissions from the overhead power lines are 37 dB (A) at a minimum distance of 49m. Thus the predicted external noise levels meet the requirements in the WHO Guidelines for Community Noise document.

1.8.3.4 Alternative Access Track

54. If constructed as consented, this planning permission (O/2011/0184/F) would mean that an alternative access to Tower 47 would be required. The Consolidated ES has described Access Track 47 (AT47), which accessed Tower 47 from the Bracknagh Road. It is now proposed that an alternative access within the existing planning application boundary will be utilised from Tower 46 to Tower 47 (AT47A – please see Figure 1.4). No change is proposed to the existing planning application boundary. The new access track AT47A will make use of the assessed access track AT46. The new access track will be used in the same manner as described in the Consolidated ES and all applicable mitigation measures within the Consolidated ES will be applied.

55. Access track AT47A will be 3m in width, approximately 219m in length and it will not be stoned. It will cross over improved grassland and will directly impact two species-poor hedgerows resulting in the removal of 6m of hedgerow. Replacement planting will be provided on completion of the construction phase to restore the affected area.

56. Access track AT47A will make use of the assessed access track AT46 which directly affects agricultural land parcels 065 and 066 and then cross land parcel 067. There will be an increase in construction traffic and the duration of construction impacts in land parcels 065 and 066 which will not result in an increase in overall impact. Land parcel 067 will now be crossed by Access Track AT47A. The change will not give rise to a significant impact and the impact to the parcel remains as 'Negligible'. There will be no change in impact on land parcel 068 as a result of this change, although there will be less access track in this land parcel.

57. With the use of the new access track AT47A, the total traffic generated at AT46 increases from 226 vehicles to 401 vehicles, over a period of 32 days, compared to the original 19 days. The maximum daily traffic flow increases to 34 movements per day. The impact of the change is not considered significant.

58. In terms of sightline requirements, as the traffic generation does not exceed 60 vehicles per day, the threshold value in DCAN 15 for the provision of more onerous sightlines is not exceeded, and therefore the sightline requirements provided for AT46 remain valid.

59. It has been assessed that the impacts of new access track AT47A will be not significant and will not change the likely significant effects as assessed in the Consolidated ES.

1.8.4 Planning Permission O/2010/0824/O

60. Planning Application O/2010/0824/O relates to outline planning permission for a dwelling. If subsequently approved and constructed, this dwelling, would require that an alternative access to a stringing location be considered. The Consolidated ES had described Access Track AT71SL2, which provided access to a stringing location for Tower 71 from the Dernalea Road. It is now proposed that an alternative access within the planning application boundary will be utilised from Tower 71 to the stringing location (AT71SL2A – please see Figure 1.5). No change is proposed to the existing planning application boundary. The new access track AT71SL2A will make use of the assessed access track AT71. The new access track will be used in the manner described in the Consolidated ES and all applicable mitigation measures within the Consolidated ES will be applied.

61. Overall, the maximum vehicles generated per day do not increase, therefore the sightlines provided for AT71 and AT71SL1 remain appropriate.

62. Access track AT71SL2A will be 3m in width, approximately 87m in length and it will not be stoned. It

will cross over a section of willow bio-remediation area and improved grassland. It will also directly impact upon one species-poor hedgerow resulting in the removal of 3m of hedgerow. Replacement planting will be provided on completion of the construction phase to restore the affected area of hedgerow and trees.

63. The area of the new access track AT71SL2A was included in the assessment of the bio-remediation area in Chapter 15 (Socio-Economics) of the Consolidated ES and the significance of the assessed impacts will not change. Overall, it has been assessed that the impacts of new access track AT71SL2A will be not significant and will not change the outcome of the assessment in the Consolidated ES.

64. Consented planning permission O/2010/0824/O has been assessed in terms of visual impacts in Appendix 1.2 of this Addendum. It has been assessed that the dwelling, if constructed, would have a moderate adverse visual impact during construction and minor adverse during operation. The house is located 130m from the overhead line and 160m from the nearest tower base. There are no significant impacts in terms of EMF and noise impacts.

1.9 Tower 102

65. Since the publication of the Consolidated ES in 2013, SONI and its designers, ESBI, have undertaken a design review of the Tyrone – Cavan Interconnector. The review was undertaken to confirm the tower design at each of the 102 towers on the overhead line. The review determined that of the 102 towers, Tower 102 requires a small change in design. The design change affects the foundations of the Tower and does not affect the above ground works. The change in foundation design is within the stated maximum tower foundation of 20 x 20 m and so the change in tower foundation design will not change the planning application boundary.

66. The change in foundation is as a result of the change in classification of the tower. In the Consolidated ES Tower 102 was reported as a 30 degree angle tower. Following the design review, it is has been changed to a 60 degree angle tower.

67. The design review determined that the tower foundation would be increased by approximately 1 m. The changes in the minimum and maximum foundation sizes are shown in Table 1.2. The revised foundations to Tower 102 are shown in Figure 1.6.

68. The design change affects the foundations of the Tower and does not affect the overall tower dimensions and so has no significant change to the overall appearance of the Tower as described in the Consolidated ES.

Table 1.2: Changes to Foundations of Tower 102

	Previous Foundation Size (2013)	Current Foundation Size (2015)	Difference
Minimum Size	15.21 x 15.21 m	16.31 x 16.31 m	+1.1 m
Maximum Size	18.71 x 18.71 m	19.51 x 19.51 m	+0.8 m

69. In Chapter 5 (Proposed Development) of the Consolidated ES, Table 5.1 and 5.2 provided a summary of the tower heights and types. As a result of Tower 102's reclassification as a 60 degree angle tower, the data in the tables require updating. Tables 5.1 and 5.2 of the Consolidated ES have been revised and are presented below. The amended text is shown as "struck through" text. Data which is unchanged is shown in grey.

Revised Table 5.1: Proposed Overhead Line Tower Design Ranges

Tower Type	Number Proposed	Maximum Height (m)[3]	Minimum Height (m)	Average Height (m)	Change from 2013 version
Suspension	66	41	28	35	No change
30° Angle Tower	~~14~~ 13	36	27	30	One less 30° tower
60° Angle Tower	~~18~~ 19	34	27	30	One more 60° tower
90° Angle Tower	4	36	25	31	No change
Overall	**102**	**41**	**25**	**34**	No change

Revised Table 5.2: Proposed Overhead Line Tower Design Summary

Tower Number	Tower Type	Tower Height (m)	Elevation (mAOD)	Overhead Line Span to Next Tower (m)
Other towers unchanged from Consolidated ES				
102	~~30° Angle Tower~~ 60° Angle Tower	33	131	350 (to T103 – EirGrid tower)

70. A review of the change has determined that there will be no change in the assessment of the impacts as presented in the Consolidated ES. The change in foundation will result in a very minor localised increase in traffic movements.

71. The difference in traffic generation terms regarding the two types of towers is related to the change in foundations/footing required for the different tower types. The 60 degree tower type requires a larger size of footing which increases both the amount of spoil to be disposed of off-site and the volume of concrete required. The 30 degree tower type is estimated to generate 79m^3 or 158 tonnes of spoil for offsite disposal compared to 146m^3 or 293 tonnes for the 60 degree tower type. This increases the trips off site (18 tonnes loads) to the waste facility from 9 to 16 trips.

72. With regards to the change in concrete required to facilitate the 60 degree tower type compared to the 30 degree tower type, the volume increases from 133m^3 to 245m^3.

73. The increase in spoil and concrete increases the amount of HGV (Heavy Goods Vehicles) trips to and from the site however the amount of LGV trips (Light Good Vehicles - staff vehicles) remains the same

[3] The heights of the towers are given as above ground level at the centre point of the tower to height at the centre point of the tallest point of the tower. For the 400 kV towers, the tallest point is the earthed shieldwires. The heights are rounded to the nearest metre.

as the number of work days remains the same at 19 days. Overall the amount of trips generated over the entire 19 day construction period increases from 266 trips to 310 trips i.e. an increase of 44 trips.

74. The overall effect of this increase in traffic is nominal, as the average traffic generation per day increases from 14 to 16 trips per day and the maximum daily traffic increases from 30 to 34 trips per day. As the additional traffic generated is HGV movements transporting spoil off site and concrete to site, the increase in traffic will be spread over the entire working day. Traffic impacts are calculated for peak periods when background traffic and generated traffic is at its maximum, generally for the weekday morning and evening time periods when people are travelling to and from work. The increase in traffic described will be outside of these time periods, so the traffic impacts included in the Transport Assessment will remain the same.

75. To summarise, the change in tower type will increase the amount of spoil and concrete due to the increase in footing size required. The total traffic generated will increase by 44 HGV trips, however the LGV trips generated and construction period of 19 days and will remain the same. The effect will be nominal as the increase in daily traffic will increase by between 2 and 4 vehicle trips per day outside of the peak periods i.e. AM and PM peak hours. Therefore the traffic impacts in these peak periods will remain the same and so there will be no change to the assessment presented in the Consolidated ES.

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Chapter 2 Joint Environmental Report



Main Text Volume 2

June 2015

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EU TEN-E Initiative

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The current. The future.

2 Joint Environmental Report

1. In May 2013, the European Commission published 'Guidance on the Application of the Environmental Impact Assessment Procedure for Large-scale Transboundary Projects[4]' (herein referred to as the 'EC Transboundary Guidance document'). The aim of the EC Transboundary Guidance document was to build on "*experience and the good practices identified so far*" in the EIA field and to provide a greater clarification of how to approach *"large - scale transboundary projects*". These types of project are defined in the EC Transboundary Guidance document as those which are "*physically located in more than one country*" (such as the proposed interconnector).

2. The EC Transboundary Guidance document describes seven steps in a Transboundary EIA for large - scale 'transboundary projects':

> *"1. Notification and transmittal of information;*
>
> *2. Determination of the content and extent of the matters of the EIA information – scoping;*
>
> *3. Preparation of the EIA information/report by the developer;*
>
> *4. Public participation, dissemination of information and consultation;*
>
> *5. Consultation between concerned Parties;*
>
> *6. Examination of the information gathered and final decision; and,*
>
> *7. Dissemination of information on the final decision."* (Page 4)

3. In terms of the scope of any prepared EIA report, the EC Transboundary Guidance document (page 9) states that the following should be included:

> *" • a description of the proposed project and its purpose;*
>
> *• a description, where appropriate, of reasonable alternatives (e.g. in terms of location, technology to be employed, etc.) and also the no-action alternative;*
>
> *• a description of the environment likely to be significantly affected by the proposed project and its alternatives;*
>
> *• a description of the potential environmental impact of the proposed project and its alternatives and an estimate of its significance;*
>
> *• a description of the mitigating measures considered and an indication of the predictive methods, assumptions and data on which they are based; and*
>
> *• an outline of monitoring and management programmes and any plans for post-project analysis.*
>
> *In addition, when determining the EIA report's scope and level of detail, it should be kept in mind that EIA has a wide scope and broad purpose and it should be carried out in a way that takes into account the specific character and effects of each project."*

4. The EC Transboundary Guidance document (page 10) further states:

> *"For large - scale transboundary projects, the developer must comply with the requirements of the national EIA requirements of each country in which the project will be implemented. The developer should prepare individual national EIA reports and a* ***joint***

[4] http://ec.europa.eu/environment/eia/pdf/Transboundry%20EIA%20Guide.pdf

> ***environmental report that covers the whole project and assesses its overall effects, in particular cumulative and significant adverse transboundary effects***. (**Emphasis** added).

5. While the EC Transboundary Guidance document (Page i) does state that it *"in no way creates any obligation for the Member States or project developers"*, it is considered a useful consolidation of current best practice for projects such as the proposed interconnector.

6. The Joint Environment Report (see Appendix 2.1 for the full report) for the proposed interconnector is intended to accompany the Consolidated ES and EIS[5] in each jurisdiction. The purpose is to provide the reader with an overview of impacts and the transboundary issues of the proposed interconnector, taking into account the EC Transboundary Guidance document. The full details of the project are contained in the respective planning applications and accompanying documents which should be read in conjunction so that the detail of the project can be fully realised.

[5] The EirGrid EIS (June 2015) is available as Appendix 1.1.

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Chapter 3
Need



Main Text Volume 2

June 2015

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Interconnector

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3 Need

3.1 Introduction

1. This Chapter sets out the rationale behind, and the need for, the proposed Tyrone-Cavan Interconnector. The proposed interconnector will form a second major transmission link between Northern Ireland and the Republic of Ireland[6]. The chapter is divided into two key sections: Policy Need and Technical Need.

2. Since publication of the Consolidated ES (2013) there have been further developments in relevant European Policy and also National and Regional policies. These recent developments are set out in chronological order in Section 3.2 (Policy Need).This update to the Policy Need in this chapter should be read in conjunction with the Need chapter of the published Consolidated ES (2013).

3. Section 3.3 of this chapter (Technical Need) sets out the current position as regards the need for, and benefits of, the proposed interconnector between the Republic of Ireland and Northern Ireland. The need for a second interconnector arises from the required development of the existing high voltage transmission network infrastructure on the island of Ireland. The chapter concludes by identifying some of the key benefits that the delivery of the proposed interconnector will provide to consumers across the island - namely:

- Improving competition - by reducing transmission system constraints (and resulting operational costs) that are currently restricting the efficient performance of the all-island Single Electricity Market (SEM);
- Improving security of supply - by providing dependable high capacity interconnection, geographically separate from the existing interconnector, between the transmission systems of Northern Ireland and the Republic of Ireland; and,
- Facilitating the development of renewable power generation - by strengthening the flexible exchange of power flows over a large area of the island of Ireland. This will facilitate the integration of larger volumes of renewable power generation (especially wind-powered generation) throughout the island and in turn help to facilitate meeting targets for renewable generation.

3.2 Policy Need for the Project

3.2.1 European Policy

3.2.1.1 Council Recommendation on the United Kingdom's 2013 national reform programme and delivering a Council opinion on the United Kingdom's convergence programme for 2012-2017

4. On 29th May 2013, the European Commission issued country-specific recommendations to Member States, including the United Kingdom, as part of its overall Europe 2020 strategy[7]. Six country specific recommendations for the UK to action within 2013-2014 to help it improve its economic performance included, inter alia, 'investment in infrastructure'.

[6] Also referred to as ‘Ireland’

[7] (COM(2013) 378 final).

5. Amongst other things, the Commission noted that the UK needed to invest in its energy and transport infrastructure if it is to continue to meet the needs of the rest of the economy over the coming decade. In terms of contribution from renewable energy sources the Commission observed that the UK is ranked 25th out of the 27 Member States in the EU and should make significant improvements when upgrading its energy infrastructure.

6. The European Council endorsed the recommendations of the European Commission on 19th June 2013[8].

3.2.1.2 Commission Services Non Paper - Green Paper 2030: Main outcomes of the public consultation

7. The European Commission published a short paper (in September 2013) which provided an overview on the participation in the consultation and the key findings from its Green Paper – A 2030 framework for climate and energy policies. The paper noted (at page 3) that:

> *"The benefits of the Internal Energy Market (IEM) were well recognized. The completion of the internal market for energy is seen as a key means to ensure competitive energy prices and secure supply. A majority of stakeholders also point out that higher interconnection capacity between Member States is fundamental to meet energy and climate objectives." [Emphasis added]*

3.2.1.3 Union List of Projects of Common Interest[9]

8. The proposed interconnector has been designated a project of common interest (PCI) for the purposes of EU Regulation 347/2013. A key aim of EU Regulation No. 347/2013 is to ensure that strategic priority energy networks in Europe are completed by 2020. Recital 28 of the Regulation states:

> *"Projects of common interest should be given 'priority status' at national level to ensure rapid administrative treatment. Projects of common interest should be considered by competent authorities as being in the public interest. Authorisation should be given to projects which have an adverse impact on the environment, for reasons of overriding public interest, when all the conditions under Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora and Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy are met".*

9. Insofar as the proposed interconnector has been designated a PCI for the purposes of the Regulation, it was therefore considered to meet the general criteria for PCIs set out in Article 4(1). These are:

> *"(a) the project is necessary for at least one of the energy infrastructure priority corridors and areas;*
>
> *(b) the potential overall benefits of the project, assessed according to the respective specific criteria in paragraph 2, outweigh its costs, including in the longer term; and*
>
> *(c) the project meets any of the following criteria:*
>
> *(i) involves at least two Member States by directly crossing the border of two or more Member States;*
>
> *(ii) is located on the territory of one Member State and has a significant cross-border*

[8] Council of the European Union, Brussels, 19 June 2013, 10660/1/13 Rev 1.

[9] Commission Delegated Regulation (EU) No 1391/2013 of 14 October 2013 amending Regulation (EU) No 347/2013 of the European Parliament and of the Council on guidelines for trans-European energy infrastructure as regards the Union list of projects of common interest.

impact as set out in Annex IV.1;

(iii) crosses the border of at least one Member State and a European Economic Area country"

10. In addition, a number of sub-articles contained in Article 7 are also of relevance in establishing the need for the project from an energy perspective. In this regard Article 7(1) states:

"The adoption of the Union list shall establish, for the purposes of any decisions issued in the permit granting process, the necessity of these projects from an energy policy perspective, without prejudice to the exact location, routing or technology of the project."

11. Article 7(3) further provides that:

"Where such status exists in national law, projects of common interest shall be allocated the status of the highest national significance possible and be treated as such in permit granting processes - and if national law so provides, in spatial planning - including those relating to environmental assessments in the manner such treatment is provided for in national law applicable to the corresponding type of energy infrastructure".

12. Article 7(8) also states that:

"With regard to the environmental impacts addressed in Article 6(4) of Directive 92/43/EEC and Article 4(7) of Directive 2000/60/EC, projects of common interest shall be considered as being of public interest from an energy policy perspective, and may be considered as being of overriding public interest, provided that all the conditions set out in these Directives are fulfilled"

3.2.1.4 The TEN-E Regulation EU 347/2013, Manual of Procedures: The permitting process for Projects of Common Interest in the UK

13. The UK Department of Energy and Climate Change published its Manual of Procedures on 1st May 2014. The Manual confirms that:

"3.8. Developers should note that the TEN-E Regulation does not change the consenting regimes applicable to energy infrastructure in the UK; the consent decision remains the responsibility of the relevant UK consenting authority. Moreover, because a project is a PCI does not mean that consent will necessarily be granted. Although PCI status establishes the need for the proposed infrastructure, any permit required for a PCI to be constructed must be determined according to the requirements of the relevant consenting regime."

3.2.1.5 Long term infrastructure vision for Europe and beyond

14. On 14th October 2013, the European Commission published its Communication on 'Long term infrastructure vision for Europe and beyond'[10]. The paper noted (at page 2) that:

"Developing our energy infrastructure will allow the Union to deliver a properly functioning internal energy market, enhance security of supply, enable the integration of renewable energy sources, increase energy efficiency and allow customers to benefit from new technologies and intelligent energy use."

[10] (COM (2013) 711 final).

15. The paper continued (at page 2) that: *"the short term priority is to complete the internal energy market by developing the missing interconnectors…".*

16. The paper confirmed (at page 4) that: "The timely implementation of the projects of common interest is a common priority... [and (at page 5) that]:"One of the objectives of the Union is to further improve interconnections with neighbouring countries".

17. The paper confirmed (at page 4) that: "The timely implementation of the projects of common interest is a common priority..." [and (at page 5) that]:"One of the objectives of the Union is to further improve interconnections with neighbouring countries".

3.2.1.6 Delivering the internal electricity market and making the most of public intervention

18. On 5th November 2013, the 'Delivering the internal electricity market and making the most of public intervention'[11] communication was published by the European Commission. The paper observed (at page 8) that:

> *"Sometimes the solution to the situation in a national market might be found in a broader regional context, involving capacities or solutions available across the border thanks to the increasingly interconnected internal electricity market".*

19. The paper further noted (at page 13) that:

> *"If generation inadequacy is identified as a serious problem following a comprehensive assessment, Member States are invited to assess the alternative measures which can equally target or minimise the generation adequacy problem. These are the promotion and enabling of demand response, including by an accelerated roll out of smart metering and expansion of interconnection capacity, in particular towards neighbouring countries with surplus electricity generation or a complementary energy mix."*

3.2.1.7 Generation Adequacy in the internal electricity market – guidance on public interventions

20. The European Commission also published its Staff Working Document, 'Generation Adequacy in the internal electricity market – guidance on public interventions'**,** on 5th November 2013[12]. This document accompanies the Communication 'Delivering the internal electricity market and making the most of public intervention' referred to above. The Staff Working Document noted (at page 19) that:

> *"Interconnectors have historically been built to enhance security of supply in Member States which have less favourable conditions for electricity generation than in neighbouring countries. This beneficial role of interconnectors is today even more relevant with more wind and solar power on the system (being unequally spread across the Union)."*

[11] (COM (2013) 7243 final).

[12] (SWD (2013) 438 final).

3.2.1.8 A single market for growth and jobs: An analysis of progress made and remaining obstacles in the member states – Contribution to the Annual Growth Survey 2014

21. On 13th November 2013 the European Commission published its Report 'A single market for growth and jobs: An analysis of progress made and remaining obstacles in the member states – Contribution to the Annual Growth Survey 2014'[13] . The Report stated (at page 12) that:

> *"Considerable investment in energy infrastructure, such as…electricity networks…is still needed so that energy flows freely and be traded across borders in order to strengthen the security of supply."*

22. The Report listed key energy market priorities (at page 14) that Members States should focus on including, *inter alia*, the priority to:

> *"Increase interconnection capacity with neighbouring countries, i.e. through fully applying the Regulation containing guidelines for trans-European infrastructure. At the same time, Member States should adopt a greater cross-border perspective in addressing security of supply challenges."*

3.2.1.9 Regulation (EU) 1316/2013 – Connecting Europe Facility

23. Regulation (EU) 1316/2013 of 11th December 2013 establishing the Connecting Europe Facility, entered into force on 21st December 2013 and applied from 1st January 2014.

24. The Regulation states that:

> *"Major investment is needed to modernise and expand Europe's energy infrastructure and to interconnect networks across borders and end the energy isolation of Member States, in order to meet the Union's energy and climate policy objectives of competitiveness, sustainability and security of supply in a cost-effective way…". [Recital 22]*
>
> *"The urgent need to build the energy infrastructure of the future and the significant increase in investment volumes compared to past trends require a step change in the way energy infrastructure is supported at Union level. In its conclusions of 28 February 2011, the Council endorsed the energy corridors as priorities for Europe." [Recital 23]*
>
> *"Regulation (EU) No 347/2013 of the European Parliament and of the Council identifies the trans- European energy infrastructure priorities which need to be implemented by 2020 in order to meet the Union's energy and climate policy objectives, sets rules to identify projects of common interest necessary to implement those priorities, and lays down measures in the field of the granting of permits, public involvement and regulation to speed up and/or facilitate the implementation of those projects, including criteria for the eligibility of such projects for Union financial assistance." [Recital 25]*

25. Article 4(3) states that:

> *"In the energy sector, the CEF shall support projects of common interest that pursue one or more of the following objectives:*
>
> *Increasing competitiveness by promoting further integration of the internal energy market and the interoperability of electricity and gas networks across borders. The achievement of this objective shall be measured ex post by:*
>
> *the number of projects effectively interconnecting Member States' networks and removing*

[13] (COM(2013) 785 final).

internal constraints;

the reduction or elimination of Member States' energy isolation;

the percentage of electricity cross-border transmission power in relation to installed electricity generation capacity in the relevant Member States;…"

26. Annex I Part II of the Regulation lists 'North South electricity interconnections in Western Europe' ("NSI West Electricity")' as a priority electricity corridor. Member States concerned include 'Ireland' and the 'UK'.

3.2.1.10 A Policy Framework for Climate and Energy in the Period from 2020 to 2030

27. On 22nd January 2014 the European Commission published its communication entitled 'A policy framework for climate and energy in the period from 2020 to 2030'[14]. The framework noted (at page 7) that:

"…the EU and Member States will need to develop further their policy frameworks to facilitate the transformation of energy infrastructure with more cross-border interconnections, storage potential and smart grids to manage demand to ensure a secure energy supply in a system with higher shares of variable renewable energy".

28. The Impact Assessment accompanying the communication outlined the main findings of the public consultation and noted (at page 8) that:

"Higher interconnection capacity between Member States is considered fundamental to meet energy and climate objectives".

"Joint planning of networks, in particular of interconnections, could play an important role to ensure the most cost-efficient and coherent solutions for infrastructure networks". (page 216)

"Industry widely supports the timely completion of the internal energy market, the development of cross-border interconnections and better coordination between national policies". (page 224) [Emphasis added]

3.2.1.11 European Parliament resolution of 5th February 2014 on a 2030 framework for climate and energy policies

29. On 5th February 2014, the European Parliament adopted a non-binding resolution on a 2030 framework for climate and energy policies in response to the Green Paper adopted by the European Commission in March 2013. The European Parliament (at para 9) called on the Commission and the Member States:

"to set a binding EU target of producing at least 30% of total final energy consumption from renewable energy sources; stresses that such a target should be implemented by means of individual national targets taking into account the individual situation and potential of each Member State."

[14] (COM(2014) 15 final).

30. The resolution stated (at para 40):

> *"… that, in order for RES production to be efficient, improvements in grid flexibility, infrastructure and energy transport capacity are required."*

31. At para. 88, the European Parliament emphasised:

> *"that security of energy supply is crucial for EU citizens and businesses" and further stressed (at para 91) that: "as the EU pursues its goal of energy security, one of the priorities is to develop a model of cooperation between the Member States by ensuring the swift completion of the EU internal energy market, including, in particular, the construction of interconnectors and the elimination of cross-border barriers; believes, furthermore, that completing and modernising the EU infrastructure linking the north, south, east and west will enable the EU to make the best use of the comparative advantages of each Member State…".*

3.2.1.12 European Council Conclusions

32. Following on from the resolution referred to above, the importance of developing interconnections between Member States was highlighted in the conclusions of the European Council on 21st March 2014[15]. The conclusions paper noted (at para 15) that:

> *"A coherent European energy and climate policy must ensure affordable energy prices, industrial competitiveness, security of supply and achievement of our climate and environmental objectives" and that the new framework should be based on principles including, inter alia, the "security of energy supply for households and businesses at affordable and competitive prices" (para 17).*

33. The conclusions paper provided (at para 19) that:

> *"The objectives of completing the internal energy market by 2014 and developing interconnections so as to put an end to any isolation of Member States from European gas and electricity networks by 2015 remains a priority."*

3.2.1.13 European Energy Security Strategy

34. The European Commission published its 'European Energy Security Strategy'[16] communication on 28th May 2014. The Strategy sets out areas where decisions need to be taken or concrete actions implemented to respond to energy security concerns. One of the 8 'pillars' of the Strategy is 'Building a well-functioning and fully integrated internal market' under which it is noted (at page 9) that: *"The primary objective of EU infrastructure policy is to now ensure the timely implementation of the PCIs."*

3.2.1.14 European Council Conclusions June 2014

35. A further conclusions paper of the European Council, published on 27th June 2014, set out the conclusions of the European Council on energy and climate and noted, *inter alia*, that:

[15] European Council, Conclusions 20/21 March 2014, EUCO 7/1/14 Rev 1.

[16] COM (2014) 330 final

"our energy and climate policies for the upcoming five years must focus on…secure energy for all our countries:…by developing the necessary infrastructure such as interconnections…" (page 18)

3.2.1.15 Progress towards completing the Internal Energy Market

36. On 13th October 2014, the European Commission published its communication entitled 'Progress towards completing the Internal Energy Market'[17]. The paper noted (at page 8) that:

> *"More investment in strategic energy infrastructure is needed… the Commission has proposed, in May 2014, to extend the current 10% interconnection target to 15% by 2030… Moreover, in October 2013, the Commission adopted the first Union list of 248 projects of common interest ('PCIs') which urgently need to be realised so as to further strengthen the integrated market. Three quarters of these projects should be completed by 2020."*

37. In relation to security of supply concerns, the paper provided (at page 14) that:

> *"Regional cooperation is crucial… in order not to forget possible cross border solutions which may be more effective and less costly. The Commission notes that neighbouring Member States such as,.. the United Kingdom and Ireland…often have complementary energy mixes with excess capacity in one country and potential deficits in the other. Integrating such markets better and finding common solutions could be cheaper and benefit all. Political commitment in the countries concerned is however a prerequisite to make such common solutions work."*

38. A Commission Staff Working Document, 'Implementation of TEN-E, EEPR, and PCI Projects'[18], which accompanied the Communication and was also published on 13th October 2014 stated (at page 5) that:

> *"A truly integrated and competitive internal energy market needs significant development of the energy transmission infrastructure, in particular cross-border interconnections between member states."*

39. A further Commission Staff Working Document, Trends and Developments in European Energy Markets 2014'[19], also published on 13th October 2014 and accompanying the Communication provided (at page 25) that:

> *"Prices in Italy, Ireland the United Kingdom and the Netherlands were among the highest in the EU in 2013, either because of the lack of sufficient interconnection capacities to neighbouring power markets (Italy and Ireland) or because of the dominance of expensive generation fuels in setting the marginal price in the wholesale market (natural gas in the case of the Netherlands and the UK)."*

40. A Commission Staff Working Document entitled 'Country Reports'[20] published on 13th October 2014 and accompanying the Communication, stated (at page 230) that: "Further investment in the UK electricity network infrastructure and generation is needed for delivery of 2020 targets. In particular,

[17] COM(2014) 634 final

[18] SWD(2014) 314 final

[19] SWD(2014) 310 final

[20] SWD(2014) 311 final

greater interconnection is needed." The document also noted that "*There is an expectation that generating margins may decrease in Northern Ireland post 2020."*

3.2.1.16 European Council Conclusions 23rd / 24th October 2014

41. On 24th October 2014, the European Council approved the 2030 framework for climate and energy. The conclusions adopted by the European Council stated (at page 6) that:

> *"The European Council noted the fundamental importance of a fully functioning and connected internal energy market… the European Council stressed that all efforts must be mobilised to achieve this objective as a matter of urgency. Preventing inadequate interconnections of Member States with the European gas and electricity networks and ensuring synchronous operation of Member States within the European Continental Networks as foreseen in the European Energy Security Strategy will also remain a priority after 2020.*

42. In addition, the following further objectives are to be met by 2030:

> *"A binding EU target of at least 40% reduction of greenhouse gas emissions by 2030 compared to 1990 and a binding target of at least 27% of renewable energy used at EU level."*

3.2.1.17 Council Conclusions on the completion of the internal energy market

43. On 9th December 2014, the Council of the European Union adopted conclusions on the completion of the internal energy market[21]. The Council identified various actions that should be taken to complete the internal energy market, including the urgent realisation of projects identified as projects of common interest so as to further strengthen the integrated energy market.

3.2.1.18 European Commission Work Programme 2015

44. On 16th December 2014, the European Commission adopted its Work Programme for 2015[22] setting out the focused actions for 2015.

45. New initiatives (as set out in Annex 1) include the adoption of a 'Strategic Framework for the Energy Union' which will focus on: energy supply security; integration of national energy markets; reduction in European energy demand; decarbonising the energy mix and promoting research and innovation in the energy field. It will include the revision of the EU Emissions Trading System as part of the legislative framework post-2020.

3.2.1.19 European Commission Framework Strategy for a Resilient Energy Union

46. On 25th February 2015, as part of the European Commission's new Energy Union Package, it published a communication entitled 'A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy'[23]. The paper warns (at page 8) that:

[21] Council of the European Union, Press Release on Completion of the Internal Energy Market dated 9th December 2014

[22] COM(2014) 910 final.

[23] COM(2015) 80 final.

"At this moment, the European electricity and gas transmission systems, notably cross-border connections, are not sufficient to make the internal energy market work properly and to link the remaining energy islands to the main electricity and gas network."

"A specific minimum interconnection target has been set for electricity at 10% of installed electricity production capacity of the Member States, which should be achieved by 2020. The necessary measures to achieve this 10% target are set out in the Commission Communication presented with this Energy Union Strategic Framework [the Interconnection Communication]. *In 2016, the Commission will report on the necessary measures to reach a 15% target by 2030."*

"The Commission will regularly take stock of the implementation of major infrastructure projects which contribute to the Energy Union, in particular in the framework of the PCI follow-up. As part of this stock-taking exercise, it will make an annual report on the progress to reach the 10% electricity interconnection target with a specific focus on the implementation of the regional action plans…"

47. The paper advises (at page 18) that: "A*chieving the Energy Union means delivering on the actions set out in this Strategy."* Action point 4 (at page 19) states that: "*The right infrastructure is a precondition for completing the energy market, integrating renewables and security of supply. The Commission will support the implementation of major infrastructure projects, particularly the Projects of Common Interest*…".

3.2.2 National and Regional Policy

3.2.2.1 No Country is an Energy Island: Securing Investment for the EU's Future, House of Lords - European Union Committee, 14th Report of Session 2012–13, 2nd May 2013[24]

48. The importance of developing interconnections between Member States was highlighted in the House of Lords European Union Committee's 14th Report of Session 2012-13. The Report noted (at page 53, para 168) that:

> *"It is cost-efficient and urgent to develop electricity interconnections between Member States in order to support both the further deployment of renewable energies and attempts to secure the EU's energy supplies."*

49. The Report continued (at page 56, para 178):

> *"We acknowledge that public concerns can be a significant obstacle to the development of interconnections. In that context, the public awareness dimension of EU energy policy becomes pivotal: a local decision can have significant pan-European implications in terms of energy cost and energy security. The Commission must consider as part of its future policy framework how it and Member States can work together to communicate effectively the benefits of cross-border energy connections. We agree that providing a clear indication that a project is part of a strategic transition towards an increasingly interconnected grid could help overcome local objections to projects. Early engagement and consultation with the public and other interest groups is similarly important."*
>
> *"We welcome recent agreement on the trans-European Energy Infrastructure Regulation, which identifies PCIs and establishes common rules on permit granting procedures. The Regulation must now be implemented with urgency." (page 66, para 236)*

[24] HL Paper 161.

3.2.2.2 Security of Electricity Supply in Northern Ireland – Utility Regulator and DETI

50. An Information Paper prepared by the Utility Regulator[25] and DETI dated 12th June 2013[26] warned that:

> *"It is therefore imperative that the second North/South Interconnector[27] is progressed and delivered as soon as possible and that the Moyle interconnector is restored to full deliverable capacity …"* [Emphasis added] *[at page 3].*
>
> *"The second North South interconnector is fundamental to the Strategic Energy Framework, in providing sufficient surplus capacity and hence security of supply for consumers in NI. The absence of this interconnector means that from 2016 NI's surplus margin is reduced from c. 600MW to c. 200 MW and from 2021, it is in deficit" [at page 4].[28]*

51. Further, the paper advised (at page 6) that:

> *"The current proposed overhead North South Interconnector will deliver substantial economic benefits to all consumers on the island. The estimated investment cost (for the NI section only) is of the order of £90m, however the benefits in terms of reduced production costs and enhanced capacity sharing, which would result from the project's development are assessed to be of the order of €30m per annum for all island consumers (NI's savings would be approximately £7m)".*

3.2.2.3 DETI Operating Plan 2013 – 2014

52. In June 2013, DETI published its 'Operating Plan 2013 – 2014' one of the key objectives of which included the:

> *"i) Continued delivery of Strategic Energy Framework re: competitive energy markets (38); security of energy supply (39); NI's energy infrastructure (40); renewables (41)".*

53. The Tyrone – Cavan interconnector is listed as a 2013/14 objective in which a target / milestone is that:

> *"During 2013/14, ensure full DETI support for the second N/S electricity interconnector".*

[25] Previously known as the Northern Ireland Authority for Utility Regulation (NIAUR).

[26] Security of Electricity Supply in Northern Ireland 'An information paper prepared by the Utility Regulator and the Department of Enterprise, Trade and Investment', 12th June 2013.

[27] Section 1.4 of the Consolidated ES Addendum provides definitions of terms used to refer to the proposed interconnector and its component sections. In the context of direct quotations from third parties, these definitions may not be applicable. Generally, third parties have used the term "North South Interconnector" to refer to the proposed interconnector (i.e. the overall project from Turleenan to Woodland). However, the quotations should be read in the context in which they are provided.

[28] Since this statement was made a time limited contract for additional reserve, as detailed in para 126 of section 3.3.3, has been agreed.

3.2.2.4 Framework for Co-operation – Spatial Strategies of Northern Ireland & the Republic of Ireland

54. The Department for Regional Development in Northern Ireland and the Department of the Environment, Community and Local Government in the Republic of Ireland published a 'Framework for Co-operation – Spatial Strategies of Northern Ireland & the Republic of Ireland' on 27th June 2013. Para 3.35 (page 22) of the Framework notes that:

> *"To maximise the benefits from a Single Electricity Market (SEM) and improve security of supply, a second North South electricity interconnector is planned. This interconnector will enhance diversity and security of electricity supply and further growth of renewable generation".*

3.2.2.5 European Priorities 2013 – 14, Winning in Europe

55. The Northern Ireland Executive's 'European Priorities 2013 – 14, Winning in Europe' strategy was agreed on 19th September 2013. The European Priorities set out how the Northern Ireland Executive will work to strengthen European engagement, to realise fully the opportunities which the European Union presents, to influence and shape future policy and build our positive profile. Two of the Northern Ireland Executive's key aims include, *inter alia*, to:

> *"Develop energy infrastructure to support both EU and Strategic Energy Framework objectives"; and to:*
>
> *"Further increase the amount of electricity and heat obtained from alternative and renewable sources".*

3.2.2.6 The Committee for Enterprise, Trade and Investment – Electricity Policy Review: DETI Briefing

56. The issue of security of supply was discussed at a DETI briefing to the Northern Ireland Assembly Committee for Enterprise, Trade and Investment meeting on 10th October 2013[29]. The Director of DETI advised that:

> *"SONI's most recent security of supply and generation capacity statement highlighted some tightness in capacity from the end of 2015 and more after 2021. However, the issue is that the island as a whole will have a surplus of generation capacity for the next 10 years. The issue for Northern Ireland is access to that capacity, which immediately brings into play the importance of the North/South interconnector. <u>If that were in place, the problem would dissipate significantly</u>." (Emphasis added)*[30]

[29] Committee for Enterprise, Trade and Investment, Official Report (Hansard), Electricity Policy Review: DETI Briefing, 10th October 2013.

[30] Since this statement was made a time limited contract for additional reserve, as detailed in para 126 of section 3.3.3, has been agreed.

3.2.2.7 The Committee for Enterprise, Trade and Investment – Electricity Policy Review: NIAUR

57. The Utility Regulator also addressed the Northern Ireland Assembly Committee for Enterprise, Trade and Investment. The Utility Regulator advised that[31]:

> *"From 2021, we are in deficit, which is a real issue. It is worth reflecting on why that is the case. The failure to deliver the North/South interconnector within the time frame projected in DETI's strategic energy framework is very significant. The framework projected its being delivered by 2013-14. We all know that that is not the case. In fact, we will probably not get it until 2018, and even that is from a positive perspective on the delivery time frame." (page 2)*
>
> *"We really need the delivery of the North/South interconnector, not just for security of supply reasons but to help the cost of energy, because it will help the market and drive down prices." (page 3)*
>
> *"We have been discussing the risk from 2016. However, if we do not do something, there will be a deficit come 2021, if the Ballylumford plant is removed. Fundamentally, therefore, it is crucial that we get the North/South interconnector in place and energised well before 2021. Additionally, we are operating with a single electricity market at the moment. All the interconnectors — the Moyle interconnector and the North/South interconnector when it comes — add flexibility. They allow us to use and procure electricity at the cheapest cost, which drives down prices, because we can sell into the GB market and procure out of it when things are not cheap." (page 9)*[32]
>
> *"The North/South interconnector will play a fundamental part in security of supply and an important part in driving down prices." (page 9) [Emphasis added]*
>
> *"If I remember correctly, when we did the cost-benefit analysis of the single electricity market to try to establish whether it had the potential to bring benefits for consumers, there were around £7 million of savings that could be made attributable to the North/South interconnector. We have not been able to get those savings in the single electricity market because we have not had that second interconnector. The cost-benefit analysis assumed the second interconnector. There are savings to be made there." (page 10)*
>
> *"The North/South interconnector is a project that will deliver lower costs." (page 10)*
>
> *"… We have identified that there is a potential security-of-supply risk, largely because of the failure to deliver the second North/South interconnector… ". (page 10)*

3.2.2.8 UK renewable energy roadmap: 2013 update

58. The Department of Energy and Climate Change published a 2013 update to the UK Renewable Energy Roadmap in November 2013. The update confirms that: The Government's commitment to cost effective renewable energy as part of a diverse, low-carbon and secure energy mix, is as strong as ever. As regards the UK's renewable energy target, the report advises that: Since the publication of the last Update in 2012, the UK has made very good progress towards our challenging 2020 renewables target, to deliver 15% of our energy demand from renewable sources. We are fully committed to achieving this target and have seen a significant amount of deployment to date, particularly in the renewable electricity sector. This was demonstrated in 2012 when more than 4% of the UK's energy came from renewable sources – above our interim target. We will continue to monitor our progress towards the target, ensuring that we have measures in place to reach our goal.

[31] Committee for Enterprise, Trade and Investment, Official Report (Hansard), Electricity Policy Review – Northern Ireland Authority for Utility Regulation, 5th November 2013.

[32] For the up to date position on generation adequacy refer to section 3.3.

3.2.2.9 The Committee for Enterprise, Trade and Investment's report on its Review into Electricity Policy, Part 1: Security of Electricity Supply

59. The Committee for Enterprise, Trade and Investment published a 'Report on the Committee's Review into Electricity Policy: Part 1 - Security of Electricity Supply' on 28th November 2013[33]. The Committee agreed to conduct a review of the evidence produced by the System Operator for Northern Ireland (SONI) in order to determine the extent of the security of supply problem and what scope there may be to resolve the situation without unduly impacting on electricity consumers. For the current position, please see section 3.3 of this chapter.

60. The Report noted that:

> *"SONI published its latest statement in January 2013. The statement demonstrates that the current generation surplus margin of 600 Mega Watt (MW) will reduce to 200 MW from 31st December 2015. This is not considered sufficient margin to ensure security of supply in the event of a prolonged outage of a large generating plant. It reported that unless steps are taken to address the problem, Northern Ireland's security of supply would be at risk from the start of 2016 and in deficit from 2021."*[34]

61. The importance of the proposed interconnector is emphasised throughout the Report. The proposed interconnector is listed in the Report as the key recommendation to ensure security of supply beyond 2020. The Report states that:

> *"The North South interconnector is a key infrastructure project to ensure Northern Ireland's long-term security of supply." (page 3)*
>
> *"Given the delays in securing a planning decision for this application, as time moves on, it becomes increasingly unlikely that an alternative could be developed and planning secured before Northern Ireland moves into a supply deficit in 2021." (page 3)*
>
> *"SONI confirmed to the Committee that the surplus margin will be tight until the commissioning of the second North South Interconnector and that this is the only solution presently under consideration that will resolve the supply risks in Northern Ireland." (page 6)*

62. The Report noted (page 10/11) that DETI, in its written submission to the Committee, stated that the Interconnector:

> *"is a major electricity infrastructure project which is required to meet the strategic energy needs of both jurisdictions. The view was also fully supported by the Utility Regulator, the Confederation of British Industry and AES. AES informed the Committee that the Interconnector is a key element in the long-term strategy because it would allow access to the most cost-efficient unit at any one time."*

63. The Utility Regulator informed the Committee (page 11) that:

> *"there is a heightened risk to security of supply from the start of 2016 due to the delay in the delivery of the North South Interconnector, which the Strategic Energy Framework*

[33] Report: NIA 145/11-15 (Committee for Enterprise, Trade and Investment).

[34] Since this statement was made a time limited contract for additional reserve, as detailed in para 126 of section 3.3.3, has been agreed.

assumed would be delivered in 2013-2014."

"In the view of the Utility Regulator, the failure to deliver the North South Interconnector within the SEF projected timeframe is very significant."

3.2.2.10 Northern Ireland Assembly's approval of the Committee for Enterprise, Trade and Investment's report on its Review into Electricity Policy, Part 1: Security of Electricity Supply

64. The Northern Ireland Assembly approved the first report of the Committee for Enterprise, Trade and Investment on its 'Review into Electricity Policy: Part 1 - Security of Electricity Supply' on 9th December 2013[35]. The Northern Ireland Assembly called on the Minister of Enterprise, Trade and Investment, in conjunction with her Executive colleagues, the Utility Regulator and SONI to implement, as applicable, the recommendations contained therein.

65. In highlighting the importance of the proposed interconnector, the Minister of Enterprise, Trade and Investment stated as follows:

"I want to mention the North/South interconnector. There have been differing views around the Chamber about the importance of the North/South interconnector. Let me reiterate this to the House: it is a critical piece of infrastructure for Northern Ireland and for the Northern Ireland electricity market.

Some people are asking why we need interconnection with the rest of the island. It is not with just the rest of the island that we are getting interconnection; there is now an interconnection between Wales and Great Britain. If we are seriously saying that we want the whole of these two islands to be interconnected, we need the two parts of this island interconnected as well. With regard to the planning, the project has been designated a project of common interest. That designation requires member states to take action to facilitate delivery of the project. I am hoping that that is going to provide an impetus to get us over the line with the North/South interconnector, because it is very important that we have the interconnection not just between Northern Ireland and the Republic of Ireland but between the two islands. So, that is hugely important." [Emphasis added]

3.2.2.11 More interconnection: improving energy security and lowering bills

66. This document (published by DECC in December 2013) sets out the UK Government's views on further interconnection.[36] The paper noted:

"Interconnection has the potential to contribute to Government's energy security, affordability and decarbonisation objectives, including through facilitating the single European electricity market. Government supports an appropriate increase in interconnection capacity through projects that efficiently deliver on these objectives." (para. 3, page 4)

"GB's security of supply would be enhanced by further interconnection, providing that electricity prices reflect scarcity and interconnector flows reflect prices. Interconnection is also one of the technologies that can assist with the integration of further low-carbon generation." (para. 5, page 4)

"The first PCI list was adopted in October 2013. Government supported six interconnection projects as PCIs (to France, Norway, and Belgium, and an interconnector between

[35] Official Report (Hansard), Monday 9th December 2013, Volume 90, No 3.

[36] DECC, 'More interconnection: improving energy security and lowering bills', 17th December 2013.

Northern Ireland and the Republic of Ireland), as well as four renewables trading projects with the Republic of Ireland with the potential to also increase interconnection capacity." (para. 44, page 13)

[Interconnection] *"has the potential to contribute to the three pillars of our energy policy – affordability, security and decarbonisation, including through facilitating the single electricity market." (para 56, page 17)*

67. The document further noted (at para 57, page 17) that the UK Government has supported six interconnection projects as PCIs including, *inter alia,* "*between Northern Ireland and the Republic of Ireland"* in the first list adopted in October 2013. The document also noted:

"The primary aim for further interconnection should be to protect the GB consumer interest in electricity networks in particular electricity bill and security of supply impacts, as well as (to the extent relevant) decarbonisation for current and future consumers." (para 60, page 17)

3.2.2.12 Security of Electricity Supply in Northern Ireland – Utility Regulator and DETI

68. In an update paper published in December 2013[37], DETI and the Utility Regulator warned that the security of supply risk remains and confirmed that a potential risk to security of electricity supply in Northern Ireland from 2016 (with a deficit from 2021) had been identified and that:

"This risk to security of supply applies only to Northern Ireland and arises because the second North South Interconnector is not expected to be operational until the end of 2017 at the earliest, and achievement of this date remains challenging".[38]

69. The paper noted that DETI and the Utility Regulator *"are working to progress feasible options and associated costs for securing additional generation capacity to operate from January 2016, at least cost to the consumer"* however, the paper warned that:

"It remains crucial that the second North South electricity interconnector is progressed and delivered as soon as possible if further risks are to be avoided from 2021 and energy costs kept to a minimum for consumers...

…While action is being taken to manage the risk from 2016, a deficit of supply continues to be projected from 2021. It therefore remains imperative that the second North South interconnector is progressed and delivered as soon as possible The North South Interconnector will also reduce energy costs for NI energy consumers".

3.2.2.13 The Committee for Enterprise, Trade and Investment – Programme for Government and Economic Strategy: Ministerial Briefing

70. The importance of the proposed interconnector was reiterated by the Minister of Enterprise, Trade and Investment at a 'Programme for Government and Economic Strategy: Ministerial Briefing on 12th

[37] 'Security of Electricity Supply in Northern Ireland - An updated information paper from the Utility Regulator and the Department of Enterprise, Trade and Investment' – 9th December 2013.

[38] Since this statement was made a time limited contract for additional reserve, as detailed in para 126 of section 3.3.3, has been agreed.

December 2013[39]. Minister Foster stated the proposed interconnector:

> *"is a critical piece of infrastructure. I cannot underline that enough. I know that there may be colleagues around the table who do not feel that it is as critical as I say it is. However, it really is a critical piece of infrastructure, because if we are not going ahead with it, that will have ramifications right across the electricity price". (page 4)*

3.2.2.14 Energy Act 2013

71. The Energy Act received Royal Assent on 18th December 2013. The Act provides for, *inter alia*, the setting of a decarbonisation target range and reformation of the electricity market to encourage low carbon electricity generation. The Act puts in place measures to attract investment which is needed to replace current generating capacity and upgrade the grid by 2020, to cope with a rising demand for electricity.

3.2.2.15 Europe 2020: UK National Reform Programme 2014

72. In April 2014 the UK Government published its National Reform Programme for 2014[40] which noted (at para. 3.187), in the context of new energy networks in Northern Ireland, that:

> *"Also, a new North South high voltage electricity link, consisting of a new 275/400 kV substation and 33.9km of 400 kV overhead transmission line from the new substation to a crossing point on the Armagh/Monaghan border is going through the planning process. The interconnector project is a commercial investment, jointly promoted by Northern Ireland Electricity and EirGrid, the Transmission System Operators in Northern Ireland and the Republic of Ireland respectively. Delivery of the project is critical to management of long term security of supply in Northern Ireland and to achievement of the Executive's commitment to increasing the use of renewable generation for the delivery of electricity."*

3.2.2.16 Ministerial Statements

73. The need for the proposed interconnector was emphasised by the Minister of Enterprise, Trade and Investment on 11th November 2013 in response to a Northern Ireland Assembly question[41]. Minister Foster stated that the proposed interconnector is *"one of the most critical pieces of infrastructure"* and *"very important for security of supply".*

74. The DETI Minister proceeded to state that *"… if we do not have the North/South interconnector, we are threatening our security of supply in a real and tangible way."* (page 28)

75. On 10th February 2014 the First Minister, Peter Robinson, in response to an oral question about the proposed interconnector[42], stated that he did "*not think there is any question about the need for the project…".* He went on to say that:

> *"as I understand it, it is absolutely essential that the project goes ahead." [Emphasis added]*

[39] Committee for Enterprise, Trade and Investment, Official Report (Hansard), Programme for Government and Economic Strategy: Ministerial Briefing, 12th December 2013.

[40] Europe 2020: UK National Reform Programme, 2014, 30th April 2014.

[41] In response to question AQO 4942/11-15, Official Report (Hansard), Monday 11th November 2013, Volume 89, No 3.

[42] In response to Question AQT 685/11-15, Official Report (Hansard), Monday 10th February 2014, Volume 91, No 7.

76. In response to a question regarding the cost to consumers from delay in building the proposed interconnector the Minister of Enterprise, Trade and Investment stated that:

> *"I am on record as stating that these are annual constraint costs. The assessment of costs is based on information included in a letter dated 9 June 2009 from the then Chief Executive of the Utility Regulator, Iain Osborne, to the then Chair of the Environment Committee, Patsy McGlone, which stated: " ....regarding the costs to consumers, the current inadequate interconnection to the all island market will cost an estimated €20-€25 million this year and possibly as much as €30 million....". Northern Ireland consumers will bear a share of these costs which on a pro rata basis is assessed at €7 million."*[43]

77. The importance of the proposed interconnector for long-term security of supply was also emphasised by the Minister for the Environment, in response to an assembly question, on 8th April 2014[44] when he noted that:

> *"I am on record as saying that the North/South interconnector is critical for our long-term security of supply, and that is still my position. As I understand it, NIE has resubmitted its revised planning application and environmental impact assessment to the Department of the Environment. We are hopeful that we can now progress on the North/South interconnector to deal with the issues that we know are in front of us. It is not that we are unaware of the consequences; we know fine well that we have a pinch point in 2016 and, indeed, another in 2021. Therefore, we need to progress with the North/South interconnector."*

3.2.2.17 DETI Operating Plan 2014 – 2015

78. *In April 2014, DETI published its 'Operating Plan 2014 – 2015'.* The North / South interconnector is listed as a 2014/15 objective in which a target / milestone is that:

> *"During 2014/15, ensure full DETI support for the second N/S electricity interconnector".*

3.2.2.18 The Committee for the Environment

79. The need for the interconnector was recently emphasised by the director of electricity from the Northern Ireland Authority for Utility Regulation at an Inquiry into Wind Energy: Northern Ireland Authority for Utility Regulation and Northern Ireland Electricity.[45] The report states (at page 4):

> *"I want to emphasise the need for the North/South interconnector. It was originally envisioned that that would be in place for 2012. It is still uncertain when it will happen, and that impacts not only on our ability to meet the renewable targets but on security of supply, which, I am sure, many of you have heard of before."*

[43] In response to Question AQW 31372/11, Official Report (Hansard), Friday 14th March 2014, Volume 93, No WA1.

[44] Official Report (Hansard), Tuesday 8th April 2014, Volume 94, No 4.

[45] Committee for the Environment, Official Report (Hansard) 19th June 2014

3.2.2.19 The Committee for Enterprise, Trade and Investment – Electricity Policy Review Part II (Electricity Pricing) and Part III (Grid Connection): Northern Ireland Authority for Utility Regulation

80. The Committee was reminded of the need for the North/South Interconnector by the Northern Ireland Authority for Utility Regulation in July 2014:

> *"…it is worth reminding the Committee of the plan for the North/South interconnector and the need for that, not only for continuing the renewables journey but also because of the implications for security of supply…" (page 3).*
>
> *"There are limitations on the system's ability to take intermittent generation. That is why… the second North/South interconnector is so important." (page 18)*

3.2.2.20 House of Commons, Energy and Climate Change, 4th September 2014[46]

81. On 4th September 2014, the Secretary of State for Energy and Climate Change in a discussion on 'European Interconnection' emphasised that: *"Increasing electricity interconnection is an important part of our policy because it supports our energy objectives."*

3.2.2.21 European Priorities 2014-15, Winning in Europe

82. The Northern Ireland Executive's European Priorities 2014-15 were agreed on 6th November 2014. Additional Priorities for the Economy thematic group include the following:

> *"Fulfil delegated Competent Authority roles in respect of obligations under the EU Trans European Networks – Energy (TEN-E) infrastructure Regulation for energy projects accepted as Projects of Common Interest (PCIs). (DETI, DOE)."*

3.2.2.22 Northern Ireland Assembly Question

83. On 10th November 2014, the Minister of Enterprise, Trade and Investment was asked how she was supporting the manufacturing sector in meeting their energy costs. In response to the question, the Minister stated, inter alia, that: "…*in the next decade, we very much need to see the implementation of the second North/South interconnector. I know that I have talked quite a lot about that subject in the House, but we really need to see progress on that."*[47]

84. On 3rd December 2014 the Minister of Enterprise, Trade and Investment was asked for an update on the proposed interconnector; and what effect the proposed interconnector will have on imperfection charges to the public. The Minister responded as follows on 15th December 2014:

> *"The planning application and revised environmental statement for the Northern Ireland part of the interconnector are currently with DOE pending referral back to the Planning Appeals Commission. I understand that EirGrid is working with the planning authority in the Republic of Ireland to agree a timetable for re-submission of its application. The constraint costs arising from the absence of the North-South electricity interconnector are estimated by the Transmission System Operators to be €20 million per annum in 2020, rising to €40 million per annum in 2030. I am advised that delivery of the Interconnector would eliminate such charges."*[48]

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[46] House of Commons, Hansard Debates, 4th September 2014, Column 421 and 422,

[47] In response to NI Assembly question AQO 6987/11-15 on 10th November 2014 (AIMS Portal).

[48] In response to NI Assembly Question AQW 39715/11-15 on 15th December 2014.

3.2.2.23 Security of Electricity Supply in Northern Ireland – Utility Regulator and DETI

85. An updated information paper was published by the Utility Regulator and DETI on 22nd December 2014. The paper notes (at page 3) that: *"Notwithstanding actions being taken now to address the security of supply risk, it remains essential for the new North-South interconnector to be delivered, which will take advantage of excess generation capacity in the Single Electricity Market and therefore provide security of supply for Northern Ireland at least cost to consumers."*

86. The paper notes (at page 5) that: *"Delay to provision of the interconnector beyond the end of the decade could result in a deficit of supply from 2021".*

87. The paper notes (at page 8) that:

> *"…the project has been designated as a Project of Common Interest under the EU TEN-E Infrastructure Regulation. The Regulation aims to facilitate improved co-ordination and consenting for large energy projects in recognition of their strategic importance to EU energy policy commitments."*
>
> *"The absence of the North-South interconnector not only contributes to security of supply issues for Northern Ireland, but also results in higher than necessary electricity prices. Delivery of the interconnector is estimated to reduce network constraint costs across the all-island market by €20m per annum in 2020 and by €40m per annum in 2030."*

88. The paper concludes (at page 9) stating that:

> *"The risk to security of supply in Northern Ireland from 2016, relates to a prolonged outage of large generation plant in the context of EU emissions reductions, and delay to the second North-South interconnector… Delivery of the new North-South interconnector, which will take advantage of excess generation capacity in the Single Electricity Market, provides security of supply for Northern Ireland at least cost to consumers. It is essential to help manage security of supply beyond 2021."*

3.2.3 Conclusion on Policy Need

89. Improvement in electricity interconnection is a key European priority as illustrated by the proposed interconnection development's status as a project of common interest. More locally, DETI and the Utility Regulator have emphasised on numerous occasions the critical status of Northern Ireland's electricity infrastructure which effects, inter alia, Northern Ireland's security of electricity supply. As such, the Minister for Enterprise, Trade, and Investment has repeatedly confirmed that development of the second North-South Interconnector is a priority for Northern Ireland.

3.3 Technical Need for the Project

3.3.1 Overview

90. An update of the technical need for the project is now provided which contains an overview of the existing transmission network, both in Northern Ireland and Republic of Ireland, an overview of the transmission system needs and the benefits of upgrading the electrical infrastructure of the grid.

91. Since the Consolidated ES was published in 2013, the 'All-Island Generation Capacity Statement 2015-2024' has been published by EirGrid and SONI. These estimations and projections are crucial in determining the need for additional grid capacity on the island of Ireland.

92. With endorsement from energy regulators and Governments in both jurisdictions (the Republic of Ireland and Northern Ireland), the respective applicants have worked jointly to identify and execute proposals for appropriate interconnection between the transmission network in the Republic of Ireland and Northern Ireland. The proposed interconnector will largely remove existing restrictions limiting cross-border power flows between the jurisdictions, thus enhancing security of electricity supply throughout the island of Ireland.

93. SONI has a statutory obligation[49] to:

> *(a) take such steps as are reasonably practicable to:*
>
> *(i) ensure the development and maintenance of an efficient, co-ordinated and economical system of electricity transmission which has the long-term ability to meet reasonable demands for the transmission of electricity; and*
>
> *(ii) contribute to security of supply through adequate transmission capacity and system reliability; and*
>
> *(b) facilitate competition in the supply and generation of electricity*

94. SONI also has licence obligations[50] relating to the development of the transmission system:

> *Under Condition 16 SONI is required to prepare, implement and comply with, a Grid Code which is, in respect of the transmission system, designed so as to permit the development, maintenance and operation of an efficient, co-ordinated and economical system for the transmission of electricity in Northern Ireland as part of efficient, co-ordinated and economical systems for the transmission of electricity on the Island of Ireland.*
>
> *Under Condition 18 SONI is required to have in force and implement Transmission Interface Arrangements the aims of which include the development, maintenance and operation of the transmission system as part of efficient, economical, co-ordinated, safe, secure and reliable All-Island Transmission Networks.*

95. Relevant considerations arising from this statutory duty and the development context for the proposed interconnector are set out in the following sections.

[49] Article 12 (2) of the Electricity (Northern Ireland) Order 1992

[50] SONI Licence to Participate in the Transmission of Electricity, March 2014

3.3.2 Existing Transmission Network Infrastructure and Development Context

3.3.2.1 Existing Electricity Infrastructure

96. The nature of electrical power transmission systems is such that electricity generation and demand must always be balanced, since it is impractical for electrical energy to be stored in bulk quantities. This means that a strategic electricity transmission system must be capable of providing a continuously stable and reliable supply of electricity throughout a wide geographic area, but also capable of immediately coping with significant changes in operating conditions.

97. Transmission systems were originally designed to cater for the receipt of power from a relatively small number of large reliable sources of power generation and to distribute that power to widely dispersed load centres (primarily centres of population). However, the requirements of the modern transmission system have changed. Firstly, to enable use of the cheapest energy sources transmission system capacity needs to be capable of transferring large amounts of electricity between a greater range of power generators and load centres. Secondly, more small-scale and renewable energy-sourced generation is seeking connection to, or use of, transmission systems. Much of this is wind-powered generation, which has an intermittent power output. Transmission System Operators (TSOs) therefore need to exchange large amounts of power to efficiently manage the variability.

98. The transmission system on the island of Ireland provides a substantial, reliable and proven corridor for balancing bulk power flows and ensuring stable system performance across the entire island. It operates at high voltages, to enable power to be transferred most efficiently, and is designed and constructed to provide a high standard of reliability and dependability.

99. Plate 3.1 shows the existing transmission networks in both jurisdictions as well as the existing interconnection between Northern Ireland and Scotland and between the Republic of Ireland and Wales.

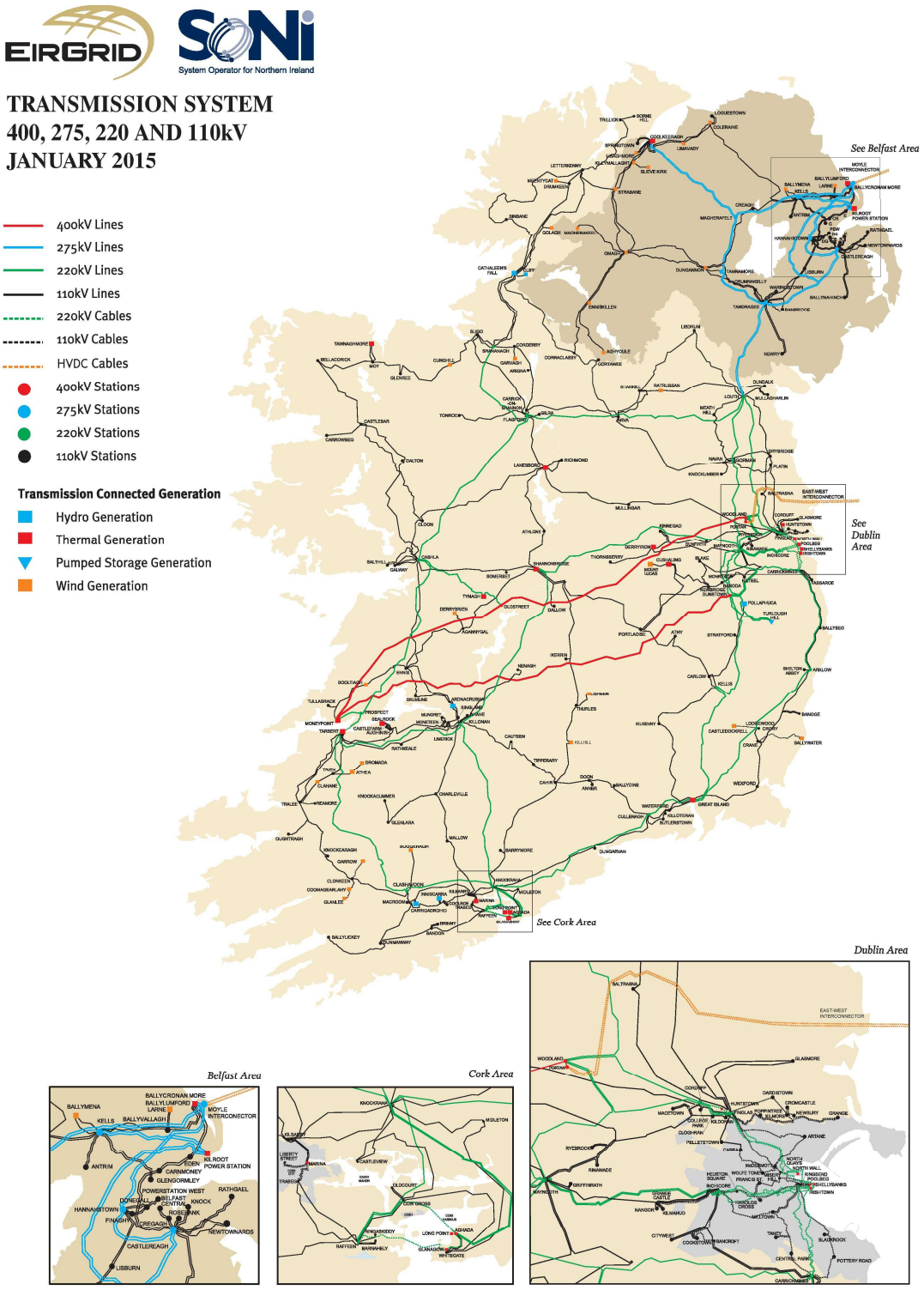

Plate 3.1: Transmission Systems in the Republic of Ireland and Northern Ireland (2015)

Also available to view at: http://www.eirgrid.com/media/All-IslandTransmissionMap.pdf

3.3.2.2 The Transmission System in Northern Ireland

100. In Northern Ireland, the strategic electricity transmission system comprises the following elements:

- The 275 kV network; and,
- The 110 kV network.

101. The bulk transmission system is made up of double circuit overhead line (two transmission circuits erected on single steel tower structures), constructed to a 400 kV standard but which is currently operated at 275 kV. The network mainly forms a double circuit loop from a number of power generation stations in the east of Northern Ireland around Lough Neagh. There is a spur from the north-western portion of that loop stretching to Coolkeeragh Substation in County Derry~Londonderry and a second spur running south from Tandragee to form the existing interconnector to Louth Substation. The lower voltage 110 kV network is the most extensive element of the grid providing supply to the Northern Ireland distribution network at a number of110/33 kV substations.

3.3.2.3 The Transmission System in the Republic of Ireland

102. In the Republic of Ireland the electricity transmission system comprises the following:

- The 400 kV network;
- The 220 kV network; and,
- The 110 kV network.

103. The 400 kV and 220 kV networks form the major 'arteries' of transmission infrastructure across the country, facilitating transfers of large amounts of electrical power from the larger power generation sources within the Republic of Ireland. Transmission of electricity at these higher voltages reduces losses and enables power to be transferred more efficiently than at lower voltages. A high voltage reliable transmission system therefore provides a conduit for bulk power flows, thereby ensuring stable performance across the entire transmission system.

104. The 500 MW High Voltage Direct Current (HVDC) East-West Interconnector between Wales and the Republic of Ireland connects into the 400 kV network at Woodland Substation and the proposed interconnector will also connect into the 400 kV network at this node, as it is the most robust in this part of the network in the Republic of Ireland.

105. The 220 kV network forms a number of largely single circuit loops across the country. The 110 kV network is the most extensive element of the overall transmission system, extending across each county. The high voltage transmission system is almost entirely constructed as overhead line infrastructure, with conductors supported on steel lattice towers at the 400 kV and 220 kV voltage level, and supported mostly on wooden pole structures at the 110 kV voltage level. These connect the major switching and voltage management points (substations), which interface at certain substations with the more extensive lower voltage distribution system.

3.3.2.4 History and Current Operation of Existing Interconnection

<u>Existing Interconnection between Northern Ireland and the Republic of Ireland</u>

106. Until 1970, the electricity systems in Northern Ireland and the Republic of Ireland operated separately. When commissioned in 1970, the first interconnector connected the two transmission networks with a nominal overhead line capacity of 1500 MW (750 MW per circuit).

107. Thus, in 1973, after commissioning Louth Substation, the Maynooth-Tandragee Interconnector was diverted into that substation to form the Louth-Tandragee double circuit 275 kV Interconnector, with a nominal capacity of 1,500 MW (750 MW per circuit), and the Louth-Maynooth 220 kV transmission line.

The two other 220 kV lines connecting to Louth Substation were commissioned in the following years to facilitate interconnection transfers and to further enhance connection with the strongest points north of Dublin.

108. In addition, two 110 kV circuits were commissioned in 1994 to provide cross-border support between local networks. One circuit links Letterkenny in County Donegal with Strabane in County Tyrone; the other links Corraclassy in County Cavan with Enniskillen in County Fermanagh. These provide emergency supply to Letterkenny and Enniskillen.

109. The existing 275 kV interconnector operates in parallel with the two 110 kV tie-lines. However, the 275 kV interconnector forms the only effective large scale interconnection pathway between the transmission systems of Northern Ireland and the Republic of Ireland. The two 110 kV tie-lines do not, on their own, have sufficient power carrying capacity to maintain synchronism between the two transmission systems. In addition the upgrade of these tie-lines would not significantly improve this because the local networks in both jurisdictions also do not have sufficient power carrying capacity. A power system protection scheme has therefore been installed to ensure that, should the existing 275 kV interconnector trip due to a fault, or is otherwise put out of service, the two 110 kV interconnectors will automatically trip, thus ensuring that they are not left on their own as the only form of interconnection between the two systems.

Existing Interconnection between Northern Ireland and Scotland

110. The existing Moyle HVDC Undersea Interconnector, operating since 2002 and running between Ballycronan More in Islandmagee, County Antrim, and Auchencrosh in Ayrshire, links the electricity systems of Northern Ireland and Scotland. The link has a capacity of 500 MW[51]. The operation of the Moyle Interconnector ended the isolation of Northern Ireland – and thus the island of Ireland – from the much larger electricity systems and markets, and indeed, the more diverse range of power generation sources, of Scotland, England, Wales, and the European mainland.

Existing Interconnection between the Republic of Ireland and Wales

111. The East-West Interconnector links the electricity systems of the Republic of Ireland and Britain and has been in operation since 2012. It runs between Woodland Substation in County Meath and Deeside in North Wales. It is a 260km HVDC underground and undersea link with the capacity to transport 500 MW of electricity.

3.3.2.5 Transmission System Needs

Limitations of Existing Interconnection between the Republic of Ireland and Northern Ireland

112. Having regard to the nature and extent of the existing interconnection infrastructure between the Republic of Ireland and Northern Ireland, there is a risk that a single event – such as a lightning strike, accidental or deliberate damage to a tower structure, a fire at one of the termination points, or a mal-operation of the complex power system protection schemes - could cause a trip of the existing double circuit 275 kV interconnector between Louth and Tandragee. In such a scenario, 110 kV tie lines would also trip and interconnection between the transmission systems of the Republic of Ireland and Northern Ireland would be lost entirely. This scenario is known as ‘system separation’; in this situation, the transmission systems in the Republic of Ireland and Northern Ireland would revert to operating independently of each other. This could result in loss of load in either or both systems as power transfer and mutual support cannot occur.

113. System separation, depending on the pre-separation interconnector flows, will result in a generation surplus in one system and a deficit in the other. The system with the deficit may be required to

[51] The Moyle Interconnector is currently limited to a capacity of 250MW due to a cable fault. Repairs are currently being planned to return the Interconnector to full capacity at a future date.

disconnect demand customers; the system with the surplus may have difficulty stabilising the system frequency. Both systems must be capable of dealing with this contingency and this puts a limit on the power transfer which the systems can cater for with the existing interconnection.

114. The respective applicants are obliged, by licence, to design the transmission systems of the two jurisdictions to be robust against a single event that would cause the quality of the electricity supplied to customers to deviate from specified quality standards. With the current extent of interconnection infrastructure between the two networks, it is possible for a single event to result in system separation. It is necessary, therefore, that the two networks are able to withstand, at all times, the sudden and unexpected loss of interconnection. The consequence of this is that under the circumstances where the existing interconnector would be required to be utilised close to its capacity an unexpected system separation would result in an unsustainable imbalance between the quantity of electricity generation and demand in one or both networks. If such an imbalance is not corrected quickly enough (i.e. within a matter of seconds) then one or both power systems will potentially collapse resulting in black-outs. Correction is normally achieved by automatic load shedding – i.e. automatically switching off large numbers of customers - on the network with the excess demand, and automatically reducing generation on the network with the excess generation.

115. In the context of such a risk scenario the TSOs have agreed that the quantity and direction of power flow on the interconnector – the Total Transfer Capacity (TTC) - be constrained below the level at which system stability can be ensured following an unexpected system separation. Therefore, while each of the two circuits of the existing 275 kV interconnector could in theory carry power flows up to 750 MW, the actual TTC of the Interconnector is limited to approximately 450 MW. This limitation creates a bottleneck in the network. The capacity available for economic power flows is less than this TTC limit as some capacity must be maintained for emergency response between the two systems. In addition, there may at times be other bottlenecks (e.g. during transmission maintenance outages) in the networks that will also limit flows in either jurisdiction. This bottleneck, seriously limits the scope for commercial exchanges of electricity between generators and suppliers in each part of the all-island electricity market, and leads to inefficiencies and costs that are passed through to final customers as part of their electricity prices. Such a limitation restricts the efficient operation of the interconnector and the attainment of the obligations of Directive 2009/72/EC or the Third Electricity Directive, which establishes *Common Rules for the Internal Market in Electricity*.

116. To address the power flow limitations described above, the proposed second interconnector needs to be physically separate from the existing interconnector so that the risk of concurrent failure will be low. Operating the transmission system with both interconnectors in service will provide enhanced security of supply in the event of the failure of either interconnector because the interconnector which remains in service can instantaneously accept the additional power flow so that there is no resulting instability in system behaviour, or loss of supply to customers.

3.3.2.6 Electrical Power Carrying Requirements

Background to Identifying the Electrical Power Carrying Requirements for the Proposed Interconnector

117. In February 2005 ESB National Grid (ESBNG) and NIE presented a paper titled *Additional Interconnection between Northern Ireland and the Republic of Ireland - Selection of Preferred Option* to their respective Regulatory Authorities. This paper considered the transmission system limitations and needs and recommended the selection of a development option comprising a 400 kV overhead line with an ultimate capacity of 1,500 MW. The recommendation was accepted by both Regulatory Authorities and ESBNG was directed by the Commission for Energy Regulation (CER) in March 2006 to carry out the necessary studies, route investigations and other investigations required for the preparation and submission of a planning application, on that basis.

Electrical Power Carrying Requirements for the Proposed Interconnector

118. It is considered by the respective applicants that the appropriate nominal electrical carrying capacity requirement for the proposed interconnector is 1,500 MW[52]. This is supported by the following:

- The proposed interconnector will form a link between the 400 kV network in the Republic of Ireland and the double circuit 275 kV network in Northern Ireland. The nominal capacity of the circuits that form these 400 kV and 275 kV networks is 1,500 MW;
- The nominal capacity of the existing North South interconnector is 1,500 MW[53]. The proposed interconnector will form a second North South interconnector and operate in parallel with the existing interconnector. A nominal capacity of 1,500 MW will therefore match that of the existing interconnector; and,
- Studies also show that power flows of up to 1100 MW would be anticipated if the present limitations imposed on the TTC were to be withdrawn. It is therefore prudent to design for 1,500 MW, that is a 1,100 MW plus a margin for future growth.

3.3.3 Benefits of the Proposed Interconnector

119. The respective applicants are satisfied that the development of an additional high-capacity electricity interconnector between the electricity networks of the Republic of Ireland and Northern Ireland is required in order to comply with, and to implement, the obligations of EU and national energy policy guidelines. The proposed interconnector provides many technical and other benefits which support the delivery of the key policy objectives of competitiveness, sustainability and security of supply for both the Republic of Ireland and Northern Ireland. At present, in order to ensure system stability across the island of Ireland, power flows on the existing interconnector are limited to a value well below its nominal capacity. This limit is applied due to the potential impact on security of supply if an unexpected outage of the existing interconnector arises at higher power flows leading to unacceptable voltage and frequency stability issues. The second North South interconnector will help to resolve this risk, as it provides a separate power flow independent of the existing interconnector, which significantly reduces the risk of system separation.

120. There are a number of benefits which arise as a result of the removal of existing constraints on power flow transfers between the Republic of Ireland and Northern Ireland. These benefits include:

Improving Competition by Reducing the Constraints Restricting Efficient Performance of the All-Island Single Electricity Market

121. In the Republic of Ireland and Northern Ireland, as in other EU countries, domestic and commercial customers were historically restricted to a monopoly supplier of electricity, with no competition in the electricity supply market place. The All-Island Project was a joint initiative run by the CER and the Northern Ireland Authority for Utility Regulation (NIAUR), the aim of which was to create a single market for natural gas and electricity on the island of Ireland. The all-island Single Electricity Market (SEM)[54] was successfully established in November 2007, commencing the trading of wholesale

[52] MVA (megavolt-amperes) is the technically correct unit of measurement for describing the capacity of transmission circuits and power transformers, and is the product of voltage (V) and current (A for amperes / amps). It has however become customary in non-technical documents to use MW for this purpose; therefore in this context, MW shall be interchangeable with MVA for the purpose of this chapter.

[53] Although the existing 275 kV double circuit overhead line has a nominal capacity of 1,500 MW the transformers at the Louth Substation end have a combined capacity of 1,200 MW.

[54] The SEM is the electricity market structure currently in place on the Island of Ireland. This market structure is due to transition into that of the I-SEM which will allow integration with the European Target model. This is scheduled to happen in 2017. The aims of both market structures are fundamentally the same.

electricity in the Republic of Ireland and Northern Ireland on an all-island basis. The aim of the SEM is to promote cross border trading in electricity for the benefit of all consumers on the island of Ireland.

122. The absence of a second North South interconnector at present means that a significant infrastructure bottleneck exists that restricts power flows between the two systems. The efficient operation of the electricity market on the island of Ireland requires an adequate and appropriate linkage of the separate transmission networks in such a way that they operate as a single synchronised transmission network. To achieve this, the level and reliability of interconnection must be such that the demand for cross border power flows can be met at all times even during system disturbances. To manage the risk of system separation, power transfers on the existing interconnector are currently limited to the level where the generation / load imbalance resulting from system separation can be managed by both systems. The existing reliance on a single interconnector is considered a significant constraint to ensuring an efficient electricity market. The constraint creates inefficiency in the market, due to the operational limits on transfer capacity and therefore excess cost for customers because it prevents the most efficient generators having unconstrained access to the market at all times.

123. With the present low level of interconnection, electricity cannot be traded in an effective way to facilitate the full benefits that the all-island single electricity market should bring to customers. The construction of an additional high capacity interconnector will diminish the possibility of system instability arising from the failure of one interconnector to an acceptable level; consequently, the transfer limit across the interconnector can be increased towards its nominal capacity, thereby permitting greater trade in electrical power, and enhanced security of supply. An additional benefit of enhanced high voltage interconnection is that the existing 110 kV tie-lines could be used more fully and would not automatically have to be removed from service in the scenario of an outage of the existing 275 kV interconnector, as is currently the case.

124. By reducing the existing infrastructure constraint between both jurisdictions, the second interconnector would remove this unnecessary congestion and, as noted mostly recently by the SEM Committee[55], would allow the all-island single electricity market to operate more efficiently, in line with its design objectives[56]. Studies by SONI and EirGrid have calculated annualised benefits to the market from the delivery of the second North-South interconnector of the order of €20m[57] per annum in 2020 rising to a range of between €40m and €60m[58] by 2030[59].

Improving Security of Supply by Providing a Reliable High Capacity Link between the Two Parts of the All-Island Transmission System

125. Due to the restrictions in the available transfer capacity of the existing interconnector, the level of security of supply support that can be provided by each system to the other is significantly limited. Previous Generation Capacity Statements[60] published jointly by EirGrid and SONI have highlighted how, for Northern Ireland, with this limited support, the availability of generation to meet forecast demand would be subject to significant risk from 2016.

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[55] SEM Committee Letter dated 18th May 2015 to EirGrid. The SEM Committee incorporates representatives from both Utility Regulator and CER and is responsible for governance of the Single Electricity Market. See Appendix 3.2 of this Addendum.

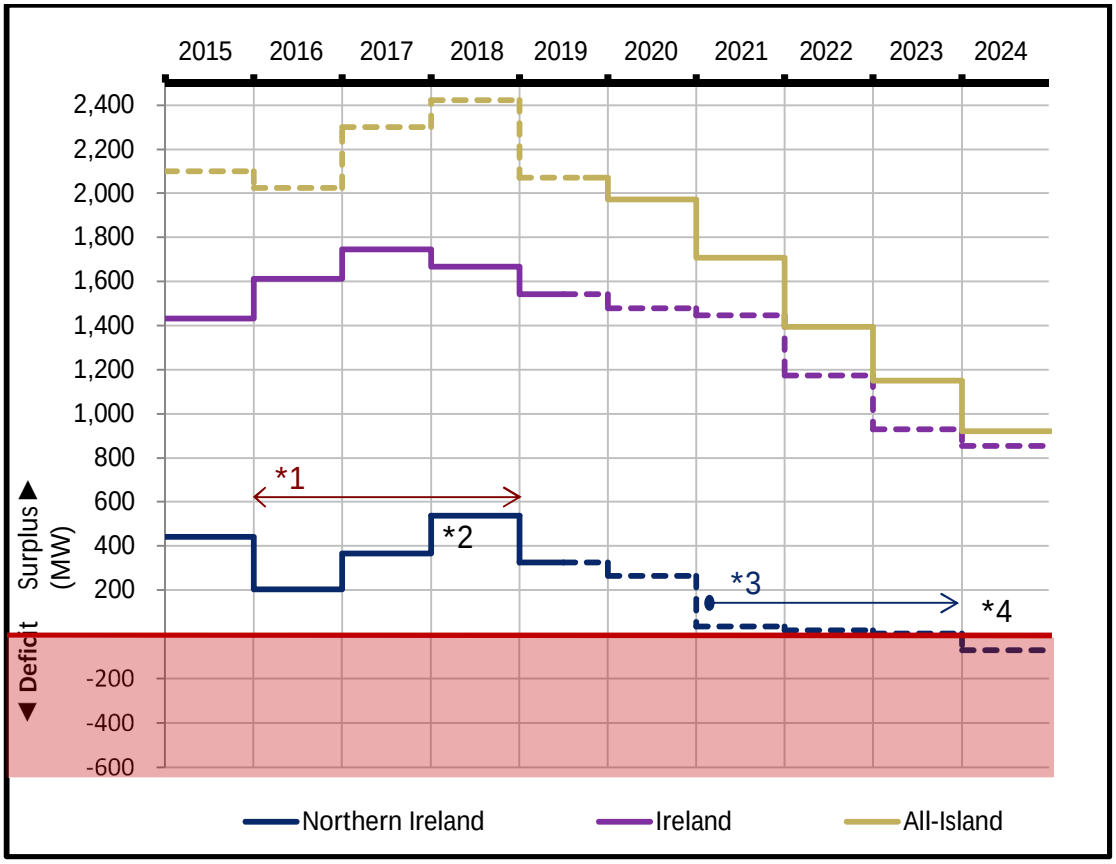
[56] The key SEM Objectives are set out at http://www.allislandproject.org/GetAttachment.aspx?id=5d50b98a-5aef-47e1-a3f7-904cc7aeac9e.

[57] Based on the exchange rate in March 2015: £14.5m

[58] Based on the exchange rate in March 2015: £29m - £43.5m

[59] See *The Need for a Second North South Electricity Interconnector*, Appendix 3.1 of this report. This paper describes the detailed calculation of associated benefits for the project.

[60] http://www.eirgrid.com/media/Generation%20Capacity%20Statement%202014.pdf



Note *1: Local Reserve services contract from 2016-2018 (inclusive)

Note *2: Moyle full capacity restored in 2018

Note *3: Kilroot coal units severely restricted from 2021

Note *4: Kilroot coal units shut in 2024

Source: *All-Island Generation Capacity Statement 2015-2024*

Plate 3.2: Forecasted Generation Capacity Adequacy on the Island of Ireland, 2015-2024

126. SONI has taken action to address the risk to Northern Ireland security of supply for a limited period, post 2016. Following a competitive procurement process, a contract has been signed between SONI and AES Ballylumford for the provision of 250 MW of local reserve services for a three-year time period commencing 1st January 2016, with an option to extend for a further 2 years. This contract has secured the operation of two of the steam units at Ballylumford at a slightly reduced capacity until 2018.

127. The graph in Plate 3.2 extracted from the 'All-Island Generation Capacity Statement 2015-2024' combines a number of assessments of generation adequacy between 2015 and 2024. The purple line presents the results of a separate generation adequacy study for the Republic of Ireland and the blue line presents the results of a separate generation adequacy study for Northern Ireland. The Republic of Ireland's results are for that jurisdiction on its own, i.e. for the Republic of Ireland's generation plant to meet the demand forecast in the Republic of Ireland, without the additional north-south interconnector but with a 100 MW reliance on Northern Ireland through the existing interconnector. Similarly the Northern Ireland study results are for that jurisdiction on its own, i.e. without the additional north-south interconnector and with a 200 MW reliance on the Republic of Ireland.

128. In addition to these two separate studies, an assessment has also been carried out to show the generation adequacy situation on an all-island basis, with all of the generation on the island being employed to meet the combined load forecast. This is indicated by the solid gold line. This assumes that the additional North-South interconnector is in place by the end of 2019.

129. For completeness, the single-area studies for the Republic of Ireland (purple) and Northern Ireland (blue) have been continued beyond 2019 (and shown as dashed lines) to illustrate the situation should the proposed interconnector be delayed. Similarly, as the results for the combined, all-island system (gold) are only applicable once the second interconnector is in place from late 2019 onwards, all-island adequacy results are also shown before late 2019 (gold dashed lines) to convey the situation should the interconnector be completed early. The benefit of this approach is that it allows a full consideration of the impact that the second north-south interconnector has on both jurisdictions over the entire period of the generation capacity adequacy assessment (2015-2024).

130. The graph illustrates how, with the addition of the local reserve services contract in 2016 and the restoration of the Moyle Interconnector to full capacity in 2018, the capacity situation in Northern Ireland is adequate up to the end of 2020 (blue line). Emissions restrictions on the generating station at Kilroot have a severe impact of system adequacy from 2021 onwards, resulting in significant risk to the security of supply in Northern Ireland if the second north south interconnector is not in place

131. With the second north-south interconnector in place (gold line), the Northern Ireland security of supply situation, as part of the combined all-island system, is no longer at risk. This highlights the importance of the proposed interconnector to maintain security of supply in Northern Ireland and also demonstrates the enduring security of supply benefit to consumers across the island in the longer term.

Supporting the Development of Renewable Power Generation by Enhancing the Flexible Exchange of Power Flows over a Large Area of the Island

132. In response to Article 4 of Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources [the Renewable Energy Directive], the Government of the Republic of Ireland has submitted a National Renewable Energy Action Plan (NREAP) to the EU Commission. Northern Ireland contributes to the United Kingdom NREAP. The Government of the Republic of Ireland and the Government of Northern Ireland have set clear policies and support measures for increasing the energy delivered from renewable energy sources on the island of Ireland. In Northern Ireland DETI is giving consideration to arrangements that will apply after the cessation of the present Northern Ireland Renewables Obligations arrangements which could have an impact on the level of renewables that will come forward in Northern Ireland. However, there is certainty that there will be a substantial amount of renewable generation connected in Northern Ireland before 2017 and in combination with the other significant drivers for the second North-South interconnector including enhanced security of supply and greater efficiency in the all island electricity market, the case of need for the proposed interconnector remains strong.

133. The geography and topography of the island of Ireland is such that both jurisdictions have substantial potential wind energy resources. The development and exploitation of these resources is expected to bring significant benefits to both economies, whilst improving the overall diversity of supply, reducing dependence on imported fossil fuels and decreasing CO_2 emissions in the power sector. In order to meet 2020 Renewable Energy Sources for Electricity (RES-E) targets in the Republic of Ireland and Northern Ireland, it is projected that the amount of wind generation across the island of Ireland will reach an installed capacity of between 4,400 MW and 5,000 MW by 2020[61]. At these levels, the Republic of Ireland and Northern Ireland will have one of the highest penetrations of renewable generation, as a percentage of system size, in the world. A key constraint to the practical development of wind powered generation is the ability of the existing transmission systems to absorb and manage this form of power generation.

134. The second North-South interconnector contributes to this objective by resolving the power transfer limitations that currently exist between both power systems. Resolving this power transfer issue will allow a re-consideration of a wide variety of operational metrics on an all-island basis. These operational metrics include operating reserve, inertia and reactive power. The ability to share these characteristics on an all-island basis not only mitigates system separation but also enhances the

[61] *All Island Generation Capacity Statement 2015-2024.*

capability of incorporating significantly greater volumes of RES-E than either system on its own could securely and efficiently manage.

135. The addition of the second interconnector therefore significantly contributes to power system stability on the island as the level of RES-E installed on the island increases to meet the future renewable targets in the Republic of Ireland and Northern Ireland.

3.4 Conclusions

136. It is a fact that both the CER and NIAUR have recommended that there exists a sound economic and strategic case for an additional high capacity interconnector linking the electricity transmission systems of the Republic of Ireland and Northern Ireland. This recommendation has been endorsed by the two Governments of these jurisdictions[62].

137. The proposed interconnector complies with EU Directives that require enhanced electricity interconnection between EU member states and improved conditions for energy competition throughout Europe.

138. The proposed interconnector is jointly supported by the Governments of both the UK and the Republic of Ireland and is fully compliant with Northern Ireland energy policy, having received specific support from the Department of Enterprise, Trade and Investment (DETI). The project is also supported by the Northern Ireland Authority for Utilities Regulation (the Utility Regulator).

139. There remains a clear and immediate strategic need for a second North-South interconnector;

140. A new and physically separate high capacity cross border interconnector circuit, connecting between appropriately robust parts of the two existing transmission networks north and south of the border, is the only option that will satisfy the identified strategic need.

141. An additional north–south interconnector ensures that the security of supply position in Northern Ireland is fully compliant with the generation adequacy standard for all study years covered in the latest All-Island Generation Capacity Statement.

142. The proposed interconnector will effectively overcome the risk of system separation and, together with associated system reinforcement, will increase transfer capacity between the two systems. This will have the strategic benefits of improving market competition in the context of the SEM, of supporting the development of renewable power generation, and of improving security of supply.

143. The resulting increase in cross-border interconnection capacity will allow consumers and producers on the island of Ireland to fully benefit from the SEM with savings of approximately €20m[63] in 2020 rising to a range of between €40m and €60m[64] by 2030.

[62] CER and NIAUR assessment and evaluation - Joint Report For the Case For a Second North South Interconnector Joint Government Endorsement: All-Island Energy Market – A Development Framework, p5, p10.

[63] Based on the exchange rate in March 2015: £14.5m

[64] Based on the exchange rate in March 2015: £29m - £43.5m

Chapter 4 Planning and Development Context



Main Text Volume 2

June 2015

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4 Planning and Development Context

4.1 Overview

1. There have been changes to the adopted and emerging policy context since the publication of the Consolidated ES (May 2013). The changes are included in the following statements:

- Planning Act (Northern Ireland) 2011;
- Planning Policy Statement 2 Natural Heritage (July 2013);
- Planning Policy Statement 16 Tourism (June 2013);
- Revised Planning Policy Statement 15 Planning and Flood Risk (September 2014);
- Noise Policy Statement for Northern Ireland (September 2014); and,
- A Strategic Planning Policy Statement for Northern Ireland (Draft) (February 2014).

4.2 Planning Act (Northern Ireland) 2011

2. On 1st April 2015, the Planning Act (Northern Ireland) 2011 (the Act) and associated legislation and regulations were introduced. These set out the Department of Environment's (the Department) functions in planning and require the Department to formulate and co-ordinate policy for securing the orderly and consistent development of land. They require the Department to exercise its functions with the objective of furthering sustainable development and promoting or improving well-being. The Act transfers a number of planning powers to new local Councils and introduces the plan led system. The effects of the changes means that the 2009 Overhead Line and 2013 Associated Works applications are now referred to as Section 26 applications (instead of being Article 31 applications under the Planning (Northern Ireland) Order 1991). This is confirmed under The Planning (2011 Act) (Commencement No.3) and (Transitional Provision) Order (Northern Ireland) 2015 Article 4 Schedule 2 paragraph 2 (3).

3. The plan led system is set out in the Act at Section 6 (4) where in making "*any determination under this Act, regard is to be had to the local development plan, the determination must be made in accordance with the plan unless material considerations indicate otherwise*". Section 45 of the Act advises that in dealing with an application "*the Department, must have regard to the local development plan so far as material to the application, and to any other material considerations*".

4. The two local development plans that are relevant to the proposal, have each been considered in the Consolidated ES. The Plans do not contain any policies of note that apply specifically to utility development. Policies that might be affected have been assessed and the proposal does not conflict with the policies in either plan. The relevant other material policy context for the proposal remains the regional policies set out in the Planning Strategy for Rural Northern Ireland and Planning Policy Statements.

4.3 Planning Policy Statement 2 Natural Heritage

5. Planning Policy Statement 2 Natural Heritage was published in July 2013. It replaces PPS 2 Planning and Natural Heritage (July 1997) and supersedes aspects of policies SP 16 Environmental Protection and DES 4 Areas of Outstanding Natural Beauty contained in A Planning Strategy for Rural Northern Ireland (September 1993) insofar as these refer to the protection of our natural heritage.

6. The objectives of this Planning Policy Statement are:

> *"i. to seek to further the conservation, enhancement and restoration of the abundance, quality, diversity and distinctiveness of the region's natural heritage;*
>
> *ii. to further sustainable development by ensuring that biological and geological diversity are conserved and enhanced as an integral part of social, economic and environmental development;*
>
> *iii. to assist in meeting international (including European), national and local responsibilities and obligations in the protection and enhancement of the natural heritage;*
>
> *iv. to contribute to rural renewal and urban regeneration by ensuring developments take account of the role and value of biodiversity in supporting economic diversification and contributing to a high quality environment;*
>
> *v. to protect and enhance biodiversity, geodiversity and the environment; and*
>
> *vi. to take actions to reduce our carbon footprint and facilitate adaptation to climate change."*

7. The policy advises that the Department should:

> *"ensure that appropriate weight is attached to designated sites of international, national and local importance; priority and protected species; and to biodiversity and geological interests within the wider environment".*

8. This approach is consistent with the general approach taken in all applications, where natural heritage is a material consideration that is placed in the planning balance.

9. PPS 2 introduces five policies that are applicable to the Tyrone - Cavan Interconnector. Policy NH 1 deals with protection of European and Ramsar Sites – International. It seeks to protect them from proposals that are likely to have a significant effect. It is noteworthy that policy NH 1 also includes exceptional circumstances which can permit a proposal to come forward where it could adversely affect the integrity of a European or Ramsar site. The criteria in such cases are similar to the criteria for bringing forward the proposal (and which the proposal has been found to be compliant with) in any event, namely where:

- "*there are no alternative solutions;*
- *the proposed development is required for imperative reasons of overriding public interest; and,*
- *compensatory measures are agreed and fully secured (by condition or planning agreement)."*

10. Policy NH 2 – Species Protected by Law seeks to prevent developments that are likely to harm European and National protected species. The Tyrone - Cavan Interconnector has been designed to minimise impacts to protected species. In the case of European species, the exceptional circumstances where a proposal can be allowed when it is likely to harm these species are:

- *"there are no alternative solutions;*
- *it is required for imperative reasons of overriding public interest;*
- *there is no detriment to the maintenance of the population of the species at a favourable conservation status; and,*
- *compensatory measures are agreed and fully secured."*

11. Again, as with NH 1, the Tyrone - Cavan Interconnector would in any event satisfy these exceptional criteria.

12. Policy NH 3 seeks to conserve sites of Nature Conservation Importance (i.e. Areas of Special Scientific Interest, Nature Reserves, National Nature Reserves or Marine reserves). The Tyrone - Cavan Interconnector avoids sites of nature conservation importance.

13. Policy NH 4 seeks to protect sites of Local Nature Conservation Importance and Policy NH 5 seeks to protect Habitat, Species or Features of Natural Heritage Importance. The Tyrone - Cavan Interconnector has minimised effects on such areas. The Tyrone - Cavan Interconnector however does bring with it clear benefits that outweigh any adverse impact on the sites, habitats, species and features affected as recognised in both policies.

14. Policy NH6 (Areas of Outstanding Natural Beauty [AONB]), does not apply as the Tyrone - Cavan Interconnector route has been designed to avoid such areas and has no impacts on AONBs.

15. In general, PPS 2 does not introduce policies which require an alteration to the methodology employed in the assessments within the Consolidated ES or to the conclusions reached by those assessments. Having reviewed its requirements, the Tyrone - Cavan Interconnector satisfies PPS 2 Natural Heritage.

4.4 Planning Policy Statement 16 Tourism

16. Planning Policy 16 Tourism was published in June 2013. The policies of this Statement supersede Tourism Policies SP10 and TOU 1 to TOU 4 of the Planning Strategy for Rural Northern Ireland (PSRNI) and also policy CTY 1 of PPS 21 as it relates to the tourism policies of PSRNI.

17. PPS 16 policy TSM 8 seeks to safeguard tourism assets. It states that:

> *"Planning permission will not be granted for development that would in itself or in combination with existing and approved development in the locality have an adverse impact on a tourism asset (as defined in the Policy Statement) such as to significantly compromise its tourism value. This policy provides for the safeguarding of all tourism assets, including those which are subject to protection for other reasons under various legislative or policy instruments and those which are not subject to such protection".*

18. Paragraph 7.42 of the policy states:

> *"What constitutes 'adverse impact 'and the determination of the extent of its influence are matters of planning judgement and each case will be assessed on its merits"*
>
> and paragraph 7.43 advises that:
>
> *"this policy is not intended to prevent all development. Development that will not significantly compromise the overall tourism value of the asset may be facilitated".*

19. The Tyrone – Cavan Interconnector does not adversely impact any tourism asset such as to significantly compromise its tourism value, either on its own or in combination with existing approved developments. Consequently, it should be facilitated as recognised in the justification and amplification text of the policy.

4.5 Revised Planning Policy Statement 15 Planning and Flood Risk

20. Revised Planning Policy Statement (PPS) 15 "Planning and Flood Risk" was issued in September 2014. The Policy outlines that the Department will not permit development unless it falls within one of the six exceptions as outlined within the Policy or it is demonstrated that the proposals are of overriding importance.

21. PPS 15 policy FLD 1 under exceptions sub-paragraph (d) identifies "*utilities infrastructure, which for*

operational reasons has to be located within the floodplain". This is expanded upon in the supporting text at paragraph 6.19 that recognises "*in certain cases, development or infrastructure has to be in such locations, as alternative lower flood risk sites would neither be practical nor available*". The Tyrone-Cavan Interconnector is utility infrastructure and is therefore an exception under policy FLD 1.

22. Notwithstanding that the Tyrone – Cavan Interconnector meets this exception test, the policy FLD 1 also recognises the need for development proposals of "*overriding regional or sub regional economic importance*". The Consolidated ES (2013) sets out the proposal's compliance with this aspect of PPS15 in that it demonstrates the exceptional benefit of the Tyrone – Cavan Interconnector to the Northern Ireland economy. The Consolidated ES also demonstrates why the elements of the proposal are required to be located within the floodplain and why alternatives are not suitable. As part of the Consolidated ES, a Flood Risk Assessment and mitigation measures have been submitted.

4.6 Noise Policy Statement for Northern Ireland

23. The Department of Environment published the Noise Policy Statement for Northern Ireland (NPSNI) in September 2014. Its objectives are to avoid or mitigate significant adverse impacts on health and quality of life; mitigate and minimise adverse impacts on health and quality of life and where possible contribute to the improvement of health and quality of life. The statement recognises the role of the planning system in preventing and minimising noise, through development management, development plan processes and through the application of planning policy statements. However, the NPSNI does not introduce specific policies that can be applied in a planning decision, and in this regard the noise assessment of the proposal has applied BS Standards and the proposal is found to comply with these.

24. Reference has been made to the Noise Policy Statement above, and there will be no Significant Adverse Effects.

4.7 Strategic Planning Policy Statement (Draft)

25. The Strategic Planning Policy Statement (Draft) was issued in February 2014. Paragraph 2.11 advises that "*This consultation draft SPPS will not be treated as a material consideration or carry weight in the determination of planning applications or during plan preparation*".

26. The applications are compliant with all extant planning policy. The SPPS is a long term shift in development management but does not alter the key themes of planning policy which remains consistent with the current suite of PPSs and the PSRNI – with sustainable development at its core.

27. It can be noted that the Draft SPPS has no weight and does not fill a policy gap. It can also be noted that paragraph 6.209 advises that "*proposals for development of new power lines will be considered having regard to potential impact on amenity and should avoid areas of landscape sensitivity, including AONBs*". The Tyrone – Cavan Interconnector complies with such a policy given it avoids all AONBs and has been routed wherever possible to minimise impacts on amenity and the rural landscape.

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Chapter 5 Cumulative Impact Assessment



Main Text Volume 2

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5 Cumulative Impact Assessment

NB This text supersedes Chapter 19 Cumulative and Interactions of Impacts of the published Consolidated ES (May 2013). The assessment has been updated and also includes the assessment of the published North-South 400 kV Interconnection Development (June 2015) and a number of newly approved projects.

5.1 Introduction

1. This Section assesses the likely significant cumulative effects of the Tyrone - Cavan Interconnector with other developments and provides a summary of interacting effects of the Tyrone - Cavan Interconnector between assessment topic areas.

2. Cumulative effects result from multiple impacts on receptors and resources. They can occur over time and can be interactive, additive, and/or synergistic in nature. Cumulative effects can also be considered as impacts resulting from "*incremental changes caused by other past, present or reasonably foreseeable actions together with the project."* (European Commission 1999: 7).

3. Cumulative effects are considered in the following ways:

    - Multiple effects from the development, and from different developments, upon the same resource;
    - Incremental effects arising from a number of small actions; and,
    - Consideration of direct effects and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects of the Tyrone - Cavan Interconnector.

4. This Section is structured as follows:

    - **Methodology** – how the cumulative effects have been identified, and approach to assessment;
    - **Assessment of Cumulative Environmental Effects** – an assessment of likely significant cumulative effects; and,
    - **Conclusions** – a summary section.

5.2 Methodology

5.2.1 Overview

5. The assessment of cumulative effects has been undertaken with regard to "Development Control Advice Note (DCAN 10) Environmental Impact Assessment" (Department of the Environment [DOE] 2012), "Department for Communities and Local Government, Planning Act 2008: Guidance on the Pre-Application Process" (March 2015) and the European Commission (1999) "Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions".

6. In the absence of specific guidelines for the assessment of cumulative effects of electricity interconnector developments, guidelines for other linear infrastructure developments have also been consulted. This has included the Design Manual for Roads and Bridges (DMRB) (2008).

7. There are two types of cumulative effects in Environmental Impact Assessment (EIA). These are:

- Cumulative impacts from a single development (i.e. interaction of impacts); and
- Cumulative impacts from other developments (i.e. impacts from other developments in combination with the impacts of the Tyrone - Cavan Interconnector).

5.2.2 Cumulative Impacts from a Single Development (Interactions)

8. These effects are typically interactive. The interaction of impacts arises from the *"combined action of a number of different environmental topic-specific impacts upon a single receptor/resource"* (DMRB 2008: 1/8). For example, the removal of trees can have landscape, visual and ecological effects, or an individual residential receptor can be affected by noise and visual impacts. Cumulative effects can also arise from different types of impact within a single topic on a receptor, such as the cumulative visual impact of vegetation removal and erection of an electricity tower on a single receptor.

9. The Tyrone – Cavan Interconnector has been submitted as two planning applications. The two applications are intrinsically linked and have been considered as one project in terms of EIA. The cumulative assessment of the two applications has been undertaken in the assessment chapters of the Consolidated ES and its Addendum. Similarly the cumulative assessment between the proposed Turleenan substation, overhead line and associated works are all cumulatively assessed where appropriate.

10. The technical assessments in the Consolidated ES (Chapters 7 – 18 and updated in the Consolidated ES Addendum where appropriate) contain assessments of the likely significant cumulative effects arising from the Tyrone - Cavan Interconnector singularly. The assessment has been based on the project as a whole and has included the two planning applications for the project in Northern Ireland. During the assessment process, coordination took place between assessment specialists to ensure that interacting impacts arising from the Tyrone - Cavan Interconnector singularly were identified, assessed and, where appropriate, mitigated and the residual impacts assessed. These impacts are reported in the individual chapters and are not repeated here. Table 5.1 outlines the likely interacting impacts and chapters where they are assessed.

Table 5.1: Interaction of Impacts of the Tyrone - Cavan Interconnector

	EMF	Water Environment	Soils, Geology and Groundwater	Ecology	Noise	Cultural Heritage	Landscape and Visual	Community Amenity and Land Use	Socio-economics	Telecomms and Aviation	Flood Risk Assessment	Transport	Air Quality and Climate
EMF				✓				✓		✓			
Water Environment			✓	✓				✓			✓		
Soils, Geology and Groundwater		✓		✓		✓		✓			✓		
Ecology	✓	✓	✓		✓		✓					✓	✓
Noise				✓				✓	✓			✓	
Cultural Heritage			✓				✓		✓				
Landscape and Visual				✓		✓		✓					
Community Amenity and Land Use	✓	✓	✓		✓		✓		✓			✓	✓
Socio-economics					✓	✓		✓					
Telecomms and Aviation	✓												
Flood Risk Assessment		✓	✓										
Transport				✓	✓			✓					✓
Air Quality and Climate				✓				✓				✓	

11. In summary, the key interactive effects are:

- Ecology and the Water Environment – interactive impacts could potentially occur to the surface water environment. They could include potential impacts on aquatic species, requiring mitigation measures;
- Ecology and Landscape & Visual – interactive impacts could potentially occur as a result of loss of habitats (hedgerows, trees, grassland, etc);
- Cultural Heritage and Landscape & Visual – interactive impacts could potentially occur in relation to the landscape character and setting of cultural heritage assets;
- Cultural Heritage and Geology & Soils – interactive impacts arising from dewatering could potentially impact on cultural heritage sites, such as historical wells; and,
- Community Amenity & Land Use, Socio-economics and other topics – interactions in the human environment are typically complex within an ES as there is the potential for receptors to be impacted in a number of ways.

12. The likely significance of these combined and interrelated impacts has been assessed within the individual assessment chapters. For instance the Landscape & Visual chapter includes an assessment of the relevant interactive ecological impacts. The converse is found in the Ecology chapter.

5.2.3 Cumulative Impacts from Other Developments

5.2.3.1 Overview

13. Cumulative effects may arise from the "*combined effects of a number of other developments, in combination with the development being assessed, on a single receptor/resource*" (DMRB 2008). This can include multiple impacts of the same or similar type from a number of developments upon the same receptor/resource.

14. For the purposes of the Tyrone - Cavan Interconnector, the categories of other developments included in the cumulative effect assessment has been taken to include:

- All overhead line developments currently in the planning process (at the time of assessment –March 2015) within 30km of the Tyrone - Cavan Interconnector [65]; and,
- Any approved and still implementable planning applications with the potential for significant cumulative effects with the Tyrone - Cavan Interconnector.

5.2.3.2 Overhead Line Developments

15. The following proposed overhead lines have been considered within the cumulative assessment (please see Figure 5.1 for location):

- Tamnamore to Omagh 110 kV network reinforcement project (planning permission approved). This is a 50 km 110 kV overhead electricity line and substation between existing NIE substations at Tamnamore (Dungannon) and Omagh. Tamnamore substation is located approximately 4.7 km to the north west of the proposed interconnector at its closest point. The Tamnamore to Omagh line is located approximately 1.6km from the proposed interconnector at its closest point; and,
- North-South 400 kV Interconnection Development (i.e. the section of the proposed interconnector in the Republic of Ireland) running from the Northern Ireland/Republic of Ireland border at a position between the townlands of Doohat or Crossreagh, County Armagh, and Lemgare, County Monaghan running south (via the Northern Ireland townland of Crossbane) to an existing substation at Woodland, County Meath.

16. As outlined in Chapter 2 of this Addendum, the European Commission published 'Guidance on the Application of the Environmental Impact Assessment Procedure for Large-scale Transboundary Projects' (May 2013). The Guidance has been considered by the respective applicants and a Joint Environment Report for the proposed interconnector has been prepared (see Chapter 2 of this Addendum and Appendix 2.1 for the full report). The Report is intended to accompany the Consolidated ES and EIS in each jurisdiction. The purpose is to provide the reader with an overview of impacts and the transboundary issues of the proposed interconnector, taking into account the EC Transboundary Guidance document. This cumulative chapter complies with the requirement of The Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2009 and 2015 for a cumulative impact assessment.

5.2.3.3 Other Developments

17. Information on planning applications was obtained from the DOE and Monaghan County Council (March 2015). A review of all planning applications with the potential for cumulative impacts with the

[65] Chapter 20 Transboundary Impacts of the Consolidated ES (and as updated in the Consolidated ES Addendum) assesses the impact of the Tyrone - Cavan Interconnector (i.e. the project within Northern Ireland) on receptors within the Republic of Ireland, as required by the EIA Regulations.

Tyrone - Cavan Interconnector was undertaken.

18. Projects to be included within the cumulative assessment were selected based on the following scoping criteria:

- Nature of the project – developments with large vertical structures as part of their development were selected because of the potential for cumulative effects with the proposed towers. In addition, other developments with significant impacts in their own right, or which required an EIA, were considered;
- Distance – developments further from the Tyrone - Cavan Interconnector were scoped out because of distance and the diminishing potential for significant cumulative effects; and,
- Scale – developments which are large scale were considered because of the potential for cumulative effects during the construction or operational phases.

19. Based on the scoping selection process, the following planning applications have been considered within the cumulative assessment (please see Figure 5.1 for location):

- M/2011/0652/F Erection of 1 no. 50 kW wind turbine with a hub height of 36.5 m to supply farm business;
- M/2008/0797/F Erection of 1 no. wind turbine;
- M/2010/0412/F Proposed installation of a GAIA (11kW) wind turbine on a 18 m high lattice tower type mast;
- M/2010/0589/F 24.8 m height 11kW white wind turbine with galvanised steel lattice tower for domestic use;
- M/2011/0465/F Erection of wind turbine (32.3 m hub height 30 m blades);
- M/2010/0913/F Erection of a Wind Turbine (50 kW Max) With a Tower height of 30 m;
- M/2009/0940/F Proposed wind turbine 1 Gaia Wind 11 kW turbine (18.3 m lattice tower construction);
- M/2008/0464/F Proposed 24 m High (10kW) domestic wind turbine;
- O/2011/0364/F Proposed erection of wind turbine with 30 m hub height and 30 m rotor diameter with a maximum output not exceeding 250 kW;
- O/2006/1142/F Erection of 33 m high wind turbine;
- O/2010/0406/F Installation of 50 kW wind turbine on 36.6 m high free standing steel mast;
- O/2010/0646/F Proposed new 20kW wind turbine on 18 m mast;
- O/2011/0195/F Erection of a single 250 kW wind turbine of 40 m tower height (55 m to tip) and control room;
- O/2007/0796/F Erection of 1 No. wind turbine 33 m high with associated site works;
- O/2010/0212/F 600 mm diameter radio transmission dish mounted on steel pole fixed to existing facade of building;
- O/2007/0374/F 15 m high 6 kW proven wind turbine for domestic use at 90 Clay Road, Keady;
- O/2007/0449/F Erection of a 15 m High 6 kW wind turbine for domestic and agricultural use at 44 Tievenamara Road;
- O/2011/0401/F Proposed 2 No. free range poultry sheds with 4 No. feed bins;
- O/2011/0539/F Replacement poultry shed with 2 No. feed bins to contain 35,000 egg

laying hens in enriched cages;

- O/2011/0412/F Proposed free range poultry shed generator store and feed bin (amended scheme to include 6 passing bays);
- M/2012/0340/F Proposed 2 No. select farm poultry sheds 4 No. feed bins and an ancillary building with biomass boiler, standby generator, office and changing facilities (each poultry shed will contain 25,850 chickens);
- O/2012/0234/F Erection of 1 no. chicken house (22,600 birds);
- O/2003/0276/A4 Proposed new chicken house;
- O/2010/0490/F Proposed free range poultry shed generator store and feed bin;
- M/2010/0717/F Proposed 2 No. poultry houses (each containing 23,000 chickens) 4 No. feed bins and an office, changing & generator building;
- M/2008/0143/F Proposed chicken house (planning permission expired May 2013);
- O/2009/0807/F Erection of 1 No. free range organic chicken house;
- O/2009/0805/F Erection of 1 No. free range organic chicken house;
- O/2009/0804/F Erection of hen house;
- M/2010/0487/F Proposed additional free range poultry shed and feed bin (to contain 6,000 free range egg laying hens);
- O/2011/0067/F Proposed Wind Turbine, hub height 40m;
- M/2012/0432/F Proposed Wind Turbine, hub height 32m;
- O/2013/0157/F Proposed Wind Turbine;
- O/2013/0464/F Proposed Wind Turbine;
- O/2013/0397/F Proposed Wind Turbine;
- O/2013/0259/F Proposed Wind Turbine;
- 10416 (Monaghan County Council Planning Reference) Four wind turbines of hub height 85 m and associated development (This planning application redesigns the permitted wind farm granted on site under Reg. ref 04/1207/ABP ref PL18.218484);
- 10480 (Monaghan County Council Planning Reference) 1) demolish existing farm buildings; (2) erect a poultry unit, manure store and egg store; (3) insert a holding tank and two number meal bins; and,
- 11358 (Monaghan County Council Planning Reference) To erect a second poultry rearing house.

20. It is accepted that the nature of the 'human environment' means that descriptions in print can quickly become 'out-of-date'. The EIA team has sought to keep aware of such changes through regular checks of submitted planning applications and site visits. The assessment is based on data up to March 2015.

5.2.4 Significance of Effects

21. The cumulative effects of other developments with the Tyrone - Cavan Interconnector are assessed against the significance criteria outlined in Table 5.2. These effects are determined from the potential impacts identified in the individual assessments. Mitigation measures are identified if required, and where relevant, residual impacts assessed.

Table 5.2: Determining Significance of Cumulative Effects

Significance	Effects
Major	Additional changes, due to relationship with other developments, substantially affecting the elements therein. For example a major impact is likely when a receptor of high sensitivity is affected by a high magnitude of additional change.
Moderate	Additional change, due to relationship with other developments, affecting, to a lesser degree or the elements therein. For example a moderate impact is likely when a receptor of medium sensitivity is affected by a medium magnitude of additional change.
Minor	Slight additional change, due to relationship with other developments. For example a minor impact is likely when a receptor of low sensitivity is affected by a small magnitude of additional change.
Imperceptible	No or minimal perceptible additional change, due to relationship with other developments.

5.3 Assessment of Cumulative Environmental Effects from Other Developments

5.3.1 EMF

22. The nature of Electric and Magnetic Fields (EMF) means that there is unlikely to be a cumulative impact with other developments. The Tamnamore to Omagh line and North-South 400 kV Interconnection Development will produce an EMF, as any electrical device would. When EMFs from more than one source add together, the cumulative impacts are not just the sum of the individual sources, but depend on the relative direction of the field as well. Because of the distance, relative direction and scale of impacts (as demonstrated in the Consolidated ES and separate EirGrid EIS), there is no significant additive effect of adding additional EMFs.

23. As well as power-frequency EMFs, there are also sources of radio-frequency EMFs, as explained in Chapter 7 of the Consolidated ES. The frequency of these is so different from power-frequency EMFs, and hence the mode of any interactions so different, that there are no cumulative impacts.

24. In considering the effect of the Tyrone - Cavan Interconnector, in terms of EMF, and potential interactions and cumulative effects associated with other development proposals (as listed in section 5.2.3 and any potential cumulative impacts between all the listed projects), it is concluded that the potential cumulative EMF impacts are **Imperceptible.**

5.3.2 Water Environment

25. Cumulative effects with other developments are only likely during the construction phase, where one or more other developments are likely to affect a watercourse that may also be affected by the construction of the Tyrone - Cavan Interconnector. The vast majority of these other developments are relatively small in scale and are located some distance from the Tyrone - Cavan Interconnector, and thus are unlikely to have any effect on the same watercourses. In addition, should any watercourse be potentially affected robust and effective mitigation measures have been set out in the Consolidated ES and once implemented significant impacts from construction site runoff or spillages from the Tyrone - Cavan Interconnector will be avoided. Overall, whilst construction of the Tyrone - Cavan Interconnector has the potential to adversely affect the water environment, the mitigation measures proposed will ensure that overall impacts are Imperceptible. Similarly long term cumulative effects on hydrological patterns will not be significant as any changes will be Imperceptible. In the context of other development proposals in the vicinity of the proposed overhead line, the assessed scale of impact, mitigation that will be implemented for the Tyrone - Cavan Interconnector and the legislative requirements imposed on other developments the cumulative impacts will be **Imperceptible**.

26. The proposed interconnector continues into the Republic of Ireland under a scheme being promoted by EirGrid. In terms of cumulative effects from a water quality perspective, these are limited to the catchment of the Clontibret Stream which flows along the border and the vicinity between Northern Ireland and the Republic of Ireland, before flowing north. With appropriate standard mitigation measures to prevent water pollution (as published in the Consolidated ES and EIS) it has been assessed that the potential cumulative Water Environment impacts are Imperceptible.

27. In considering the effect of the Tyrone - Cavan Interconnector, in terms of the water environment, and potential interactions and cumulative effects associated with other development proposals (as listed in section 5.2.3 and any potential cumulative impacts between all the listed projects), it is concluded that the potential cumulative the water environment impacts are **Imperceptible.**

5.3.3 Geology and Soils

28. It is considered that none of the other developments pose a significant risk to the ground and/or groundwater conditions because of the scale of the development and the assessed likely impacts. Impacts arising from the Tyrone - Cavan Interconnector on soils, geology and groundwater are site-specific and would be limited to the immediate area of the proposed towers. As a result, the other developments will not increase the potential effects on the ground and groundwater conditions. Accordingly, it is concluded that cumulative effects on the soils, geology and groundwater conditions would be **Imperceptible.**

29. The North-South 400 kV Interconnection Development is similar in nature to the Tyrone - Cavan Interconnector. The potential impacts to geology and soils will primarily result from the proposed towers. Given the distance of each tower from the next and the nature of the impacts, cumulative impacts between towers are unlikely. It is considered that there are no likely geology and soil cumulative impacts between the proposed substation at Turleenan and the North-South 400 kV Interconnection Development. Standard mitigation measures (as outlined in the Consolidated ES and EIS) will be undertaken to reduce the significance of any impacts. For these reasons it has been assessed that the potential cumulative Geology and Soils impacts are **Imperceptible.**

30. In considering the effect of the Tyrone - Cavan Interconnector, in terms of geology and soils, and potential interactions and cumulative effects associated with other development proposals (as listed in section 5.2.3 and any potential cumulative impacts between all the listed projects), it is concluded that the potential cumulative geology and soils impacts are **Imperceptible.**

5.3.4 Ecology

5.3.4.1 Tamnamore to Omagh

31. The EIA of the Tamnamore to Omagh 110 kV network reinforcement project determined that there are low numbers of wintering birds (swans and geese) that would be affected however, impacts would not be significant. With standard mitigation measures applied by both developments, there will be no significant cumulative effects to wintering birds. Overall, it is has been determined that there will be no significant cumulative ecological impacts between the Tamnamore to Omagh 110 kV network reinforcement project and the Tyrone - Cavan Interconnector (**Imperceptible**).

5.3.4.2 Other Developments

32. A number of small-scale wind turbine schemes have also been proposed within the general vicinity of the Tyrone - Cavan Interconnector. Collision with turbines and turbine rotors is an additional risk for birds that may also cross the line of the Tyrone - Cavan Interconnector, and this risk, particularly to wintering swans, will be cumulative over time. It is unlikely that individual turbines will present a significant risk to either the local or regional distribution of the species of concern, and it has been determined that the nature and scale of the other assessed developments means that there is unlikely

to be a significant cumulative impact on these species when considered in combination with the Tyrone - Cavan Interconnector (**Imperceptible**).

33. It has been determined that the nature and scale of the other identified developments means that there are unlikely to be significant cumulative ecological impacts (**Imperceptible**).

5.3.4.3 North-South 400 kV Interconnection Development

34. Cumulative impacts on habitats within the ecological study area and with respect to the wider countryside are limited by the small footprint of individual towers, and the significance of any impacts is limited by the low conservation interest of the habitats that are likely to be affected. Habitats of conservation importance have been avoided as a result of the route selection process. Direct habitat impacts are largely restricted to improved grassland and hedgerows. Hedgerows are a Northern Ireland Priority Habitat, but effects will be highly localised, mainly restricted to a reduction in hedgerow height, with hedgerows generally being retained.

35. The habitats in the Republic of Ireland in the vicinity of the border are similar to those within the study area of the Tyrone - Cavan Interconnector and this will lead to further losses of primarily agricultural and pasture land, essentially relating to the footprint of each structure. Whilst increasing the amount of habitat lost, permanent losses are small. Construction practices and mitigation measures (as published in the Consolidated ES and EIS) will ensure that losses are minimised. Overall, while losses of these habitats will be additive to losses arising from other human activities, including agriculture and extensions of the built environment, the cumulative impact on habitats arising from the construction and operation of the proposed interconnector is likely to be **Imperceptible**.

36. There is some potential for cumulative impacts on mammal species, but none of these are likely to be significant. Badgers and otters may have home ranges that straddle the border, but the actual small footprint of the proposed interconnector means that these species are unlikely to be adversely affected. No badger setts are likely to be damaged as a result of the proposed interconnector, and the nature of the overhead line, with widely spaced towers of limited area, means that there will be no fragmentation of territories or restrictions on free movement of terrestrial mammals of conservation concern. With standard mitigation (as published in Consolidated ES and EIS) applied during the construction of the overall development there will be no cumulative impacts on these species (**Imperceptible**).

37. Bat surveys undertaken for the Tyrone-Cavan Interconnector identified two trees and one building used as roosts by individual bats that will be removed during construction. The low levels of usage of potential roosts in the immediate vicinity of the Tyrone - Cavan Interconnector and the retention of flightline hedgerows where these are adjacent to tower locations indicate that there will be no impact on the distribution of bat species as a result of the proposed interconnector. Areas that are currently used by bats as foraging areas will in large part be retained, and the risk of bats colliding with overhead lines is assessed to be Imperceptible. In the likely absence of adverse impacts on numbers or distribution of bat species arising from the proposed interconnector, cumulative impacts on these species are likely to be low and of Imperceptible significance (**Imperceptible**).

38. Mitigation measures for bats will focus on habitat creation around the new substation and the placement of bat boxes in mature trees along the Tyrone - Cavan Interconnector will provide many more roosting opportunities for bats than at present ensuring that bat populations are not adversely affected. It is not anticipated that there will be any displacement of foraging bats and only minor displacement of roosting bats as a result of the proposed interconnector and therefore cumulative impacts are very unlikely and, where present, would be of Imperceptible significance (**Imperceptible**).

39. There will be no cumulative impacts on smooth newts as a result of the proposed interconnector. Small areas of potentially suitable foraging land will be lost as part of the construction works but smooth newt populations are small at best and absent from large parts of the proposed interconnector and significant areas of land exist in both Republic of Ireland and Northern Ireland to support any smooth newt populations (**Imperceptible**).

40. There is a potential collision risk for wintering swans that are qualifying features of the Lough Foyle and Lough Neagh and Lough Beg Special Protection Areas during at least part of the species' annual cycle. This risk extends also to that part of the proposed interconnector that extends into Ireland, and to other overhead line schemes in the general vicinity. Collision with overhead lines is a major cause of

mortality for all swan species in the UK and Ireland. However, the sub-parallel orientation of the proposed overhead line with regard to the likely dominant direction of migration and dispersion of these birds indicates that mortality arising from collision is likely to be of low significance with respect to the populations of the protected sites and of the island of Ireland as a whole. Whooper swans that use Lough Foyle as a staging area and the Keady lakes as a wintering area may also use foraging sites in Ireland. Individual birds therefore show considerable mobility within their winter range, and there is a potential for these birds to cross the line of the interconnector, particularly in Ireland, with a consequent risk of collision. However, the numbers using the Blackwater catchment in the Republic of Ireland are generally restricted to 20-40 birds (Crowe 2005), and birds using the lakes of south Armagh are also generally present in very small numbers. Surveys of wintering swans carried out for the proposed interconnector in Northern Ireland indicate that there is a low risk of birds crossing the line of the Tyrone - Cavan Interconnector. The impact on swans that may use sites on both sides of the border is likely to be of imperceptible significance in terms both of population numbers and on availability of feeding sites. Standard mitigation measures in the form of bird flight diverters, (as published in Consolidated ES and its Addendum and EIS) designed to make the overhead line more visible in those parts considered to present the greatest risk will be installed in both jurisdictions, and will reduce the overall risk of collision (**Imperceptible**).

41. There is a potential for minor impacts on the habitats of the majority of the breeding bird species that are present in the corridor of the proposed overhead line. Breeding bird populations in these habitats are generally thinly distributed, and there will be minor impacts on bird distributions at a local level, and there is unlikely to be an impact on breeding bird numbers arising from the proposed interconnector. In the absence of significant impacts on breeding birds, it is unlikely that cumulative impacts on these species will arise (**Imperceptible**).

42. For a small number of breeding birds, there is a risk of mortality for individual birds arising from collision during the breeding season. This is particularly the case with larger birds that soar or are otherwise likely to fly at higher altitudes. Examples are common buzzard, red kite and mute swan, all of which are known to be susceptible to varying degrees to collision, and all of which have been recorded as casualties in the Republic of Ireland. However, the locally low population densities of susceptible birds, or their local absence, suggest that collisions are likely to be few, and the cumulative impact on these species is likely to be **Imperceptible**.

43. For the reasons stated it has been assessed that the potential cumulative ecology impacts are **Imperceptible**.

5.3.4.4 Overall Ecological Cumulative Assessment

44. In considering the effect of the Tyrone - Cavan Interconnector, in terms of ecology, and potential interactions and cumulative effects associated with other development proposals (as listed in section 5.2.3 and any potential cumulative impacts between all the listed projects), it is concluded that the potential cumulative ecology impacts are **Imperceptible.**

5.3.5 Noise

45. Because of the distance from the Tyrone - Cavan Interconnector, it is considered that none of the other developments have the potential for significant cumulative noise impacts. The North-South 400 kV Interconnection Development, if constructed at the same time as the Tyrone - Cavan Interconnector, has the potential to generate a number of working areas in the same general location. However, because of the distance between the towers (for example, there are approximately 350m between the last tower in Northern Ireland [T102] and the first tower in the Republic of Ireland [T103]), and given the existence of standard mitigation measures there will be no significant impacts.

46. The operational noise of the proposed interconnector has been assessed through the Consolidated ES and EirGrid's EIS. It has been determined that there will be no likely significant cumulative effects in terms of noise because of the emitted noise levels and distance of receptors.

47. In considering the effect of the Tyrone - Cavan Interconnector, in terms of noise, and potential

interactions and cumulative effects associated with other development proposals (as listed in section 5.2.3 and any potential cumulative impacts between all the listed projects), it is concluded that the likely cumulative noise impacts are **Imperceptible.**

5.3.6 Cultural Heritage

48. There are no identified developments that would have a significant cumulative impact on cultural heritage within the study area. This is because of the distance, scale and nature of the other developments. The proposed Tamnamore to Omagh overhead line is over 1.6km from the Tyrone - Cavan Interconnector and there are no likely cumulative impacts given the distance and nature of the developments. As both the SONI and EirGrid sections of the proposed interconnector propose a standard programme of archaeological mitigation, cumulative impacts on previously unrecorded heritage assets will be **Imperceptible**.

49. In considering the effect of the Tyrone - Cavan Interconnector, in terms of cultural heritage, and potential interactions and cumulative effects associated with other development proposals (as listed in section 5.2.3 and any potential cumulative impacts between all the listed projects), it is concluded that the potential cumulative cultural heritage impacts are **Imperceptible.**

5.3.7 Landscape and Visual

5.3.7.1 Overview

50. A review of the other developments listed in section 5.2.3 identified eight developments as requiring additional cumulative assessment:

- Tamnamore to Omagh 110 kV network reinforcement project;
- Poultry Houses (App No M/2010/0717/F);
- Wind Turbine (M/2011/0465/F);
- North-South 400 kV Interconnection Development (June 2015);
- M/2012/0432/F Wind turbine;
- O/2013/0464/F Wind turbine;
- O/2013/0157/F wind turbine; and
- O/2009/0807/F Erection of 1 No. free range organic chicken house.
- O/2013/0397/F Wind turbine
- O/2013/0259/F Wind turbine

51. Updated photomontages have been provided as figures in this report. Viewpoints 30, 32, 33 and 34 from the Consolidated ES were updated to reflect the finalised location of the EirGrid towers.

5.3.7.2 Tamnamore to Omagh 110 kV network reinforcement project

52. This is a 50km 110 kV overhead electricity line and substation between existing NIE substations at Tamnamore, Dungannon and Omagh. The Tamnamore substation is located approximately 4.7km to the NW of the proposed interconnector at its closest point. The Tamnamore to Omagh line is located approximately 1.6km from the proposed interconnector at its closest point.

Cumulative Landscape Character Effects

53. A cumulative ZTV (Figure 5.2) has been produced which illustrates areas of combined visibility between the proposed Tamnamore to Omagh 110 kV network reinforcement project and the Tyrone - Cavan Interconnector. The ZTV shows that much of the northern part of the study area would have combined theoretical visibility, with large areas lying between the two proposals (between the M1 road corridor and western edges of Moy) and more separated large patches beyond this, towards the edges of the study area boundary. There are also some smaller patches of combined theoretical visibility on top of drumlin summits to the west of Benburb and east of Blackwatertown, although at this distance (>5km) the Tamnamore to Omagh 110 kV network reinforcement project is likely to be barely discernible. The resulting cumulative impact is therefore assessed as **Imperceptible**.

LCA 64: Lough Neagh Peatlands

54. Lough Neagh Peatlands LCA is considered to have Medium Sensitivity to change. Some of the areas of combined theoretical visibility, within this LCA lie within 1km of the Tamnamore to Omagh 110 kV network reinforcement project. These same areas are however, distant from the Tyrone - Cavan Interconnector and when the Tyrone - Cavan Interconnector is considered in combination, the resulting cumulative effect is assessed as **Imperceptible** (as defined by Table 5.2).

LCA 45: Dungannon Drumlins and Hills

55. Dungannon Drumlins and Hills LCA is considered to have Medium Sensitivity to change. Areas of combined theoretical visibility within this LCA, that lie beyond the M1 corridor have, in reality, no visibility of the Tyrone - Cavan Interconnector proposals. For the other areas of theoretical visibility within this LCA, no additional change would be experienced when the Tyrone - Cavan Interconnector is considered in combination with the Tamnamore to Omagh 110 kV network reinforcement project. This is due to a combination of distances relative to each proposal from any given part of the LCA and the layers of intervening vegetation that lie across this LCA, which limit changes to the experience of character. Therefore, when the Tyrone - Cavan Interconnector is considered in combination, the resulting cumulative effect is assessed as **Imperceptible** (as defined by Table 5.2).

LCA 47: Loughgall Orchard Belt

56. Loughgall Orchard Belt LCA is considered to have Medium Sensitivity to change. Areas of combined theoretical visibility within this LCA, tend to be focussed in the areas lying between the two proposals (between the M1 road corridor and western edges of Moy). Other areas to the east of the Tyrone - Cavan Interconnector are distant from the Tamnamore to Omagh 110 kV network reinforcement project. Overall, additional change would be experienced in several parts of this LCA when the Tyrone - Cavan Interconnector is considered in combination with the Tamnamore to Omagh 110 kV network reinforcement project. Taking this into account and when the Tyrone - Cavan Interconnector is considered in combination, the resulting cumulative effect is assessed as **Moderate** (as defined by Table 5.2).

Cumulative Visual Effects

57. Viewpoints 1, 4 and 6 have been identified as having the potential for cumulative visual effects with the Tyrone - Cavan Interconnector in combination with the proposed Tamnamore to Omagh 110 kV network reinforcement project.

Viewpoint 1

58. Viewpoint 1 is considered to have Medium Sensitivity to change. From this viewpoint the Tamnamore to Omagh 110 kV network reinforcement project would be a distant element in views to the west and would not be viewed simultaneously with the Tyrone - Cavan Interconnector proposals. When considered in combination, the addition of the Tamnamore to Omagh 110 kV network reinforcement would cause a barely discernible change to the view. Taking this into account and when the Tyrone - Cavan Interconnector is considered in combination, the resulting cumulative effect is assessed as

Imperceptible (as defined by Table 5.2).

Viewpoint 4

59. Viewpoint 4 is considered to have Medium Sensitivity to change. From this viewpoint the Tamnamore to Omagh 110 kV network reinforcement project would be a distant element in views to the west and would not be viewed simultaneously with the Tyrone - Cavan Interconnector proposals. When considered in combination, the addition of the Tamnamore to Omagh 110 kV network reinforcement would cause a barely discernible change to the view. Taking this into account and when the Tyrone - Cavan Interconnector is considered in combination, the resulting cumulative effect is assessed as **Imperceptible** (as defined by Table 5.2).

Viewpoint 6

60. Viewpoint 6 is considered to have Medium Sensitivity to change. From this viewpoint, the Tamnamore to Omagh 110 kV network reinforcement project is theoretically visible along the A29 road corridor. However, in reality, views from this viewpoint are restricted by subtle variations of road alignment that limit views to the straight section of the road that the Tamnamore to Omagh 110 kV network reinforcement project crosses. Other sections of the Tamnamore to Omagh 110 kV network reinforcement project would be screened by drumlin slopes and successive layers of vegetation that intervene. When considered in combination, the addition of the Tamnamore to Omagh 110 kV network reinforcement would cause no additional change to the view. Therefore, when the Tyrone - Cavan Interconnector is considered in combination, the resulting cumulative effect is assessed as **Imperceptible** (as defined by Table 5.2).

5.3.7.3 Poultry Houses (App No M/2010/0717/F)

61. This is an application for 2 No proposed Poultry Houses, 4 No Feed Bins and an Office Changing & Generator Building. The application site is located to the south of the proposed Turleenan substation and approximately 100m from the nearest proposed interconnector tower.

62. Viewpoints 2, 3 and 5 have been identified as having the potential for cumulative visual effects with this proposed application.

Viewpoint 2

63. Viewpoint 2 is considered to have Medium Sensitivity to change. From this viewpoint, when the Tyrone - Cavan Interconnector is considered in combination, the addition of the proposed poultry houses would cause a barely discernible change to the view due to partial screening from roadside trees that line Derrygawley Way. Taking this into account and when the Tyrone - Cavan Interconnector is considered in combination, the resulting cumulative effect is assessed as **Imperceptible** (as defined by Table 5.2).

Viewpoint 3

64. Viewpoint 3 is considered to have Medium Sensitivity to change. From this viewpoint, the addition of the proposed poultry houses would cause minimal changes to the view, when the Tyrone - Cavan Interconnector is considered in combination. Taking this into account, the resulting cumulative effect is assessed as **Imperceptible** (as defined by Table 5.2).

Viewpoint 5

65. Viewpoint 5 is considered to have Medium Sensitivity to change. From this viewpoint, when the Tyrone - Cavan Interconnector is considered in combination, the addition of the proposed poultry houses would cause a barely discernible change to the view. Taking this into account the resulting cumulative effect is assessed as **Imperceptible** (as defined by Table 5.2).

5.3.7.4 North-South 400 kV Interconnection Development

Cumulative Landscape Character Effects

66. A cumulative ZTV (Figure 5.3) has been produced which illustrates areas of combined visibility between the proposed North-South 400 kV Interconnection Development and the Tyrone - Cavan Interconnector. The ZTV shows a central swathe of combined theoretical visibility would stretch approximately from Drumark in Northern Ireland to Lisdrumgormly in the Republic of Ireland, following the open drumlin valley that is typical of this part of the study area. There are some smaller patches of combined theoretical visibility on top of the drumlin summits within the 5km study area and on more elevated landscapes to the east and west beyond the 5km study area.

LCA 66: Armagh Drumlins

67. Armagh Drumlins LCA is considered to have High Sensitivity to change. A minimal amount of additional change would be experienced in southernmost parts of this LCA but the overall LCA would be largely unaffected when the Tyrone - Cavan Interconnector is considered in combination with the North-South 400 kV Interconnection Development. Taking this into account and when the Tyrone - Cavan Interconnector is considered in combination, the resulting cumulative effect is assessed as **Imperceptible** (as defined by Table 5.2).

LCA 68: Carrigatuke Hills

68. Carrigatuke Hills LCA is considered to have Medium Sensitivity to change. No additional changes would be experienced when the Tyrone - Cavan Interconnector is considered in combination with the North-South 400 kV Interconnection Development and the resulting cumulative effect is assessed as **Imperceptible** (as defined by Table 5.2).

LCA 6: Mullyash Uplands

69. Mullyash Uplands LCA is considered to have High Sensitivity to change. Additional change would be experienced when the Tyrone - Cavan Interconnector is considered in combination with the North-South 400 kV Interconnection Development largely due to the wider reaching influence that the North-South 400 kV Interconnection Development would have on those parts of this LCA that lie within the study area. Taking this into account and when the Tyrone - Cavan Interconnector is considered in combination, the resulting cumulative effect is assessed as **Moderate** (as defined by Table 5.2).

LCA 2: Blackwater Valley and Drumlin Farmland

70. Blackwater Valley and Drumlin Farmland LCA is considered to have High Sensitivity to change. No additional changes would be experienced when the Tyrone - Cavan Interconnector is considered in combination with the North-South 400 kV Interconnection Development and the resulting cumulative effect is assessed as **Imperceptible** (as defined by Table 5.2).

Cumulative Visual Effects

71. Several viewpoints (30, 32, 33 & 34) have been identified as having the potential for cumulative visual effects with the North-South 400 kV Interconnection Development.

Viewpoint 30 (Crossbane Road, near Tower 102)

72. Due to the larger influence that the North-South 400 kV Interconnection Development would have on Viewpoint 30, substantial additional change would be experienced when the Tyrone - Cavan Interconnector is considered in combination with the North-South 400 kV Interconnection Development. Taking this into account and when the Tyrone - Cavan Interconnector is considered in combination, the resulting cumulative effect is assessed as **Moderate - Major** (as defined by Table 5.2).

Viewpoint 32 (Minor road north-east of Castleshane, RoI)

73. Viewpoint 32 is considered to have Medium Sensitivity to change. From this viewpoint, the North-South 400 kV Interconnection Development would be barely discernible and only minimal additional change would be experienced when the Tyrone - Cavan Interconnector is considered in combination with the North-South 400 kV Interconnection Development. Taking this into account the resulting cumulative effect is assessed as **Imperceptible** (as defined by Table 5.2).

Viewpoint 33 (Scenic view from Tullybuck (Clontibret - RoI))

74. Viewpoint 33 is considered to have High Sensitivity to change. No additional changes would be experienced when the Tyrone - Cavan Interconnector is considered in combination with the North-South 400 kV Interconnection Development and the resulting cumulative effect is assessed as **Imperceptible** (as defined by Table 5.2).

Viewpoint 34 (Mullyash Mountain)

75. Viewpoint 34 is considered to have High Sensitivity to change. Additional change would be experienced when the Tyrone - Cavan Interconnector is considered in combination with the North-South 400 kV Interconnection Development, due to the larger influence that the North-South 400 kV Interconnection Development would have on this viewpoint. Taking this into account, the resulting cumulative effect is assessed as **Moderate** (as defined by Table 5.2).

Dwellings

76. The approved application M/2010/0717/F (proposed poultry houses) has cumulative visual impacts which have the potential to affect several dwellings. Of the dwellings assessed in the non-cumulative individual dwellings assessment (Section 13.6.2.2. Chapter 13 Landscape and Visual) the following dwellings lie within 500m of the approved application: - A1, A2, A3, A4, A5, A6, A7 and A8. Each of these dwellings has been assessed as having a High sensitivity.

77. For dwellings A1, A3, A6 and A7 no additional change would be experienced when the Tyrone - Cavan Interconnector is considered in combination with the application M/2010/0717/F resulting in a **Imperceptible** cumulative effect (as defined by Table 5.2).

78. For dwelling A8 minimal additional change would be experienced when the Tyrone - Cavan Interconnector is considered in combination with the application M/2010/0717/F resulting in a **Imperceptible** cumulative effect (as defined by Table 5.2).

79. For dwellings A2, A4 and A5 additional change would be experienced when the Tyrone - Cavan Interconnector is considered in combination with the application M/2010/0717/F resulting in a **Moderate** cumulative effect (as defined by Table 5.2).

80. Several dwellings have been identified as having the potential for cumulative visual effects with the approved application M/2011/0465/F erection of wind turbine. Of the dwellings assessed in the non-cumulative individual dwellings assessment (Chapter 13 Landscape and Visual for the Consolidated ES) the following dwellings lie within 500m of this proposal B9, B9+, B10 and B23. Each of these dwellings is assessed as having a High sensitivity.

81. For dwellings B9, B9+ and B10 the wind turbine would be barely discernible and when the Tyrone - Cavan Interconnector is considered in combination with application M/2011/0465/F only minimal additional change would be experienced resulting in a **Imperceptible** cumulative effect (as defined by Table 5.2).

82. For dwelling B23 additional change would be experienced when the Tyrone - Cavan Interconnector is considered in combination with the application M/2011/0465/F resulting in a **Moderate** cumulative effect (as defined by Table 5.2).

83. Several dwellings have been identified as having the potential to be affected by cumulative visual impacts with the North-South 400 kV Interconnection Development. Of the dwellings assessed in the

non-cumulative individual dwellings assessment (Chapter 13 Landscape and Visual of the Consolidated ES) the following dwellings lie within 500m of the North-South 400 kV Interconnection Development: J48, J51, J51+, J52, J55, J59, J60, J61 & J62. Each of these dwellings is assessed as having a High sensitivity.

84. For dwelling J55 no additional change would be experienced when the Tyrone - Cavan Interconnector is considered in combination with the North-South 400 kV Interconnection Development resulting in a **Imperceptible** cumulative effect (as defined by Table 5.2).

85. For dwellings J52 and J62 minimal additional change would be experienced when the Tyrone - Cavan Interconnector is considered in combination with the North-South 400 kV Interconnection Development resulting in a **Imperceptible** cumulative effect (as defined by Table 5.2).

86. Due to the larger influence that the North-South 400 kV Interconnection Development would have on dwelling J59, additional change would be experienced when the Tyrone - Cavan Interconnector is considered in combination with the North-South 400 kV Interconnection Development resulting in a **Moderate** cumulative effect (as defined by Table 5.2).

87. Due to the larger influence that the North-South 400 kV Interconnection Development would have on dwellings J48, J51, J51+, J60 and J61 substantial additional change would be experienced when the Tyrone - Cavan Interconnector is considered in combination with the North-South 400 kV Interconnection Development resulting in a **Major** cumulative effect (as defined by Table 5.2).

88. In summary, for the purposes of the Landscape and Visual element, significant cumulative effects are limited to the following receptors:

- LCA 47: Loughgall Orchard Belt arising from arising from the Tyrone - Cavan Interconnector proposals in combination with the Tamnamore to Omagh 110 kV network reinforcement project;
- LCA 6: Mullyash Uplands arising from the Tyrone - Cavan Interconnector proposals in combination with the North-South 400 kV Interconnection Development;
- Viewpoint 30 and Viewpoint 34 arising from the Tyrone - Cavan Interconnector proposals in combination with the North-South 400 kV Interconnection Development;
- Dwellings A2, A4 and A5 arising from the Tyrone - Cavan Interconnector proposals in combination with poultry houses application M/2010/0717/F;
- Dwelling B23 arising from the Tyrone - Cavan Interconnector proposals in combination with Wind Turbine application M/2011/0465/F; and,
- Dwellings J48, J51, J51+, J59, J60 and J61 arising from the Tyrone - Cavan Interconnector proposals in combination with the North-South 400 kV Interconnection Development.

5.3.7.5 M/2012/0432/F Wind turbine

89. This application is the erection of wind turbine (32.3m hub height, 16m blades) located approximately 210m from the Tyrone-Cavan Interconnector.

Cumulative Landscape Character Effects

90. The height of the turbine and its location near Tower 10 means it is likely to be visible within some sections of the drumlin landscape by some receptors.

91. It will be located on elevated ground approximately 430m NE of 14 Culkeeran Road, Moy, Dungannon and will introduce another man made vertical feature into the landscape.

LCA 47: Loughgall Orchard Belt

92. Loughgall Orchard Belt Landscape Character Area (LCA) is considered to have Medium Sensitivity to change. The non-cumulative magnitude of change is considered to be High during construction and Medium – High for Year 1 and Year 15.

93. Areas of combined theoretical visibility, within this LCA, tend to be focussed in the areas lying to the western edges of Moy.

94. There would be no perceptible change to character experienced in parts of this LCA when the Tyrone-Cavan Interconnector is considered in combination with the Wind Turbine and the magnitude of change ratings would be Negligible. The resulting cumulative impact would be Imperceptible during construction, in the winter year of commissioning and in summer 15 years after commissioning.

95. With regard to the criteria for the significance of cumulative impacts set out in this Section, this impact is considered to be **Imperceptible** (see Table 5.2).

Cumulative Visual Effects

96. Viewpoints 6, 7 and 8 have been identified as having the potential for cumulative visual effects with this proposed application (M/2012/0432/F).

Viewpoint 6

97. Viewpoint 6 is considered to have Medium Sensitivity to change. The non-cumulative magnitude of change is considered to be Medium - High during construction and Medium for Year 1 and Year 15.

98. From this viewpoint the wind turbine would be visible along stretches of the A29 road corridor, however, these views would be successive in relation to the proposed overhead line, with the substation screened by topography and successive layers of vegetation that intervene.

99. When considered in combination with the Tyrone-Cavan Interconnector the addition of the proposed turbine would cause barely perceptible additional changes to the view. The cumulative magnitude of change is therefore considered to be No Change during construction, Year 1 and Year 15 and as a result, the cumulative impact would be **Imperceptible** (see Table 5.2) during construction, in the winter year of commissioning and in summer 15 years after commissioning.

Viewpoint 7

100. Viewpoint 7 is considered to have Medium Sensitivity to change. The non-cumulative magnitude of change is considered to be Medium during construction and for Year 1 and Year 15.

101. The introduction of the wind turbine would be viewed in combination with the Tyrone-Cavan Interconnector. To a very small portion of the view, it would further bring development to an area where there are already vertical man made elements in the landscape. The turbine will be of similar scale to the proposed towers of the Tyrone-Cavan Interconnector and will appear more distant in the view. The turbine will introduce movement of the rotating blades, which will occupy a very small part of the view. The cumulative magnitude of change therefore is considered to be Low resulting in **Minor** (see Table 5.2) cumulative impact during construction, in the winter year of commissioning and in summer 15 years after commissioning.

Viewpoint 8

102. Viewpoint 8 looks along Gorestown Road, to an enclosed landscape with drumlins and hedgerows limiting views. It is considered to have Medium Sensitivity to change. Overall the non-cumulative magnitude of change is considered to be Low-Medium. There would be Moderate adverse effects during construction and Minor –Moderate effects for Year 1 and Year 15.

103. It is possible that the moving tips of the wind turbine could be viewed in the centre of the view. However, given local topography and screening, the tips would be barely discernible, the cumulative magnitude of change is considered to be Negligible. The cumulative effects arising from the introduction of the wind turbine would therefore be **Imperceptible** (see Table 5.2) during construction, winter year of commissioning and in summer 15 years after commissioning.

Dwellings

104. The approved wind turbine application has been identified as having the potential to have cumulative visual effects on several dwellings. Of the dwellings assessed in the non-cumulative individual dwellings assessment (Section 13.6.2.2. Chapter 13 Landscape and Visual of the Consolidated ES) the following dwellings lie within 500m of this proposal B8, B11 and B12.

105. Each of these dwellings are assessed as having a High sensitivity.

106. For dwelling B8, the non-cumulative magnitude of change during construction was assessed as Low - Moderate and Low – Negligible during operation, resulting in Moderate Adverse effects during construction and Minor – Moderate adverse during operation.

107. When considered in combination with the proposed wind turbine, the cumulative magnitude of change is considered to be Low to Negligible during construction and operation due to screening provided by adjacent buildings, and vegetation and the oblique nature of views of the turbine. The cumulative effect therefore would be **Minor** (see Table 5.2) during construction in the winter year of commissioning and in summer 15 years after commissioning.

108. For dwelling B12, the non-cumulative magnitude of change was assessed as Negligible during construction, winter year of commissioning and in summer 15 years after commissioning. When the Tyrone-Cavan Interconnector is considered in combination with the wind turbine application, the cumulative magnitude of change is considered to be Negligible. The turbine would introduce a vertical man made structure and movement into a localised small portion of the view, which would be visible above the local topography and adjacent woodland in the context of the overhead line of the Tyrone-Cavan Interconnector, resulting in a Negligible cumulative effect during construction; and then in the winter year of commissioning and in summer 15 years after commissioning resulting in **Minor** (see Table 5.2) cumulative effects.

5.3.7.6 O/2013/0464/F Wind turbine

109. This is an application for an Endurance 55kW E3120 Wind Turbine on Tubular Tower to support existing farm business (46m tip height). The application is located approximately 168m SW of 151 Battleford Road Armagh Co. Armagh BT61 8BT and is located in line with Tower 43 of the Tyrone-Cavan Interconnector.

Cumulative Landscape Character Effects

LCA 66: Armagh Drumlins

110. Armagh Drumlins LCA is considered to have High Sensitivity to change. The non-cumulative magnitude of change is considered to be Medium - High during construction, Year 1 and Year 15. The erection of the consented scheme would be a similar development to other wind turbines that occur in the area of this LCA. The cumulative magnitude of change would result in a very small effect to a very localised area. The overall LCA would be largely unaffected when the Tyrone-Cavan Interconnector is considered in combination with the application. The cumulative magnitude of change would therefore be considered Negligible. The resulting cumulative impact would therefore be **Minor** (see Table 5.2) during construction, in the winter year of commissioning and in summer 15 years after commissioning for the Armagh Drumlins LCA.

Cumulative Visual Effects

111. Viewpoints 16 and 19 have been identified as having the potential for cumulative visual effects with this proposed application.

Viewpoint 16

112. Viewpoint 16 is considered to have High Sensitivity to change. The non-cumulative magnitude of change is considered to be High during construction, Year 1 and Year 15. This viewpoint looks south east along the B115 which, sits in a landscape with hedges, scattered mature trees and small mixed woodlands within a gentle drumlin landscape. From this viewpoint there would be successive views of the wind turbine to the north west of the Tyrone-Cavan Interconnector. The introduction of this tall

structure at the extremity of the overall view is considered to result in Low - Negligible magnitude of change. This would result in a **Moderate – Minor** (see Table 5.2) cumulative effect during construction, in the winter year of commissioning and in summer 15 years after commissioning.

Viewpoint 19

113. Viewpoint 19 is considered to have High Sensitivity to change. The non-cumulative magnitude of change is considered to be Negligible during construction, Year 1 and Year 15.This viewpoint is located at Navan Fort and the landscape in this view is heavily wooded with mainly deciduous, well managed, small blocks. From this location, there is screening from mature trees and the drumlin topography to the distant overhead line and views of the Tyrone-Cavan Interconnector have been assessed as barely perceptible. The turbine, would introduce a light coloured moving object which would be discernible on the horizon. The cumulative change in view would be slight and over a very limited area. Taking this into account the cumulative magnitude of change is considered to be Negligible. This results in a **Minor** effect (see Table 5.2), in the winter year of commissioning and in summer 15 years after commissioning.

114. For an assessment of the impact to the setting of Navan Fort refer to Cultural Heritage Chapter 12 of the Consolidated ES.

Dwellings

115. Of the dwellings assessed in the non-cumulative individual dwellings assessment (Section 13.6.2.2. Chapter 13 Landscape and Visual of the Consolidated ES) the following dwellings lie within 500m of the proposed wind turbine application: E20, E22, E23, E24 and E25. Each of these dwellings is assessed as having a High sensitivity.

116. For dwelling E20, the non-cumulative magnitude of change was assessed as High - Medium during construction, winter year of commission and in summer 15 years after commissioning. When the Tyrone-Cavan Interconnector is considered in combination with the wind turbine application, the cumulative magnitude of change is considered to be Low- Medium. The turbine would introduce a noticeable change to a small portion of a successive view. The vertical man made structure is in close proximity to the receptor and there would be the introduction of movement, which is likely to be visible from upper storeys, although with the potential for partial filtering from adjacent tree cover. The cumulative effect arising from the application is considered to be **Moderate** (see Table 5.2) at construction, winter year of opening and at 15 years after commissioning resulting.

117. Due to existing screening from buildings and vegetation, for dwelling E22, the non-cumulative magnitude of change was assessed as Negligible during construction, winter year of commission and in summer 15 years after commissioning, and as a result had a Minor Adverse effect. When the Tyrone-Cavan Interconnector is considered in combination with the wind turbine application, the cumulative magnitude of change is considered to be Negligible. The cumulative impact would be **Minor** (see Table 5.2) also for construction, winter year of commissioning and in summer 15 years after commissioning.

118. For dwelling E23, the non-cumulative magnitude of change was assessed as Negligible during construction, winter year of commission and in summer 15 years after commissioning, When the Tyrone-Cavan Interconnector is considered in combination with the wind turbine application, the cumulative magnitude of change is considered to be Negligible. Views of the entire turbine might be possible, however the introduction of a vertical man made structure and movement would affect a localised small portion of the view, with distant views of the overhead line. The cumulative effect would be **Imperceptible** (see Table 5.2) during construction. In the winter year of commissioning and in summer 15 years after commissioning, the cumulative impact would be **Moderate-Minor** (see Table 5.2) effects.

119. For dwelling E24, the non-cumulative magnitude of change was assessed as Low during construction, winter year of commission and in summer 15 years after commissioning, When the Tyrone-Cavan Interconnector is considered in combination with the wind turbine application, the cumulative magnitude of change is considered to be Negligible. The turbine would be visible in successive views to the west and obscured in part by adjacent large agricultural sheds. The resulting cumulative effect during

construction, in the winter year of commissioning and in summer 15 years after commissioning is considered to be **Minor** (see Table 5.2).

120. For dwelling E25, the non-cumulative magnitude of change was assessed as High – Medium with Moderate to Major Adverse effects during construction, winter year of commission and in summer 15 years after commissioning. As for dwelling E24, the turbine would be viewed successively within the context of large agricultural sheds. Therefore, when the Tyrone-Cavan Interconnector is considered in combination with the wind turbine application, the cumulative magnitude of change is considered to be Low -Negligible. The cumulative effect arising from the turbine is considered to be **Minor** (see Table 5.2) cumulative effect during construction, in the winter year of commissioning and in summer 15 years after commissioning.

5.3.7.7 O/2013/0157/F wind turbine

This application is the erection of wind turbine (26.83 Hub height) with alterations to existing access and is situated in an elevated position near Tower 96 approximately 93m from the Tyrone-Cavan Interconnector.

Cumulative Landscape Character Effects

LCA 66: Armagh Drumlins

121. Armagh Drumlins LCA is considered to have High Sensitivity to change. The non-cumulative magnitude of change is considered to be Medium - High during construction, Year 1 and Year 15. The erection of the consented scheme would be a similar development to other wind turbines that occur in the area of this LCA. The cumulative magnitude of change would result in a minor effect to a very localised area. The overall LCA would be largely unaffected when the Tyrone-Cavan Interconnector is considered in combination with the application. The cumulative magnitude of change is therefore considered to be Negligible. The resulting cumulative impact would be **Minor** (see Table 5.2) during construction, in the winter year of commissioning and in summer 15 years after commissioning for the Armagh Drumlins LCA.

Cumulative Visual Effects

Viewpoint 27

122. The sensitivity of this viewpoint is considered to be High. The non-cumulative magnitude of change is considered to be High during construction, year 1 and year 15. The view point looks south west down Derrynoose Road across a rolling landscape with drumlins and is contained by some hedgerows and large specimen trees. The turbine will appear slightly at the right extent of the view. Only blade tips will possibly be visible therefore the cumulative magnitude of change is considered to be Low-Negligible. When considered in combination the addition of the wind turbine would cause a barely discernible change to the view.

123. Taking this into account the cumulative effect from this viewpoint arising from the implementation of this cumulative scheme would be **Minor** (see Table 5.2). No change is expected during construction, winter year of commissioning or in summer 15 years after commissioning (**Imperceptible**).

Viewpoint 32

124. Viewpoint 32 is considered to have Medium Sensitivity to change. The non-cumulative magnitude of change is considered to be Medium - High during construction, Year 1 and Year 15. Tyrone-Cavan Interconnector towers would be visible on the horizon. As the turbine is a moving, solid object, light in colour the O/2013/0157/F application will tend to catch the eye on the distant horizon and is considered to be more visible than the proposed towers of the Tyrone-Cavan Interconnector. The turbine application will appear within the same part of the horizon as the Tyrone-Cavan Interconnector although the additional influence this application would have on this viewpoint is judged to be minimal. Taking this into account, the magnitude of cumulative change for this scenario is predicted to be Low - Negligible.

125. The resulting cumulative impact would therefore be **Moderate-Minor Adverse**(see Table 5.2) during construction, in the winter year of commissioning and in summer 15 years after commissioning and as a result, the cumulative impact would be **Imperceptible** (see Table 5.2) during construction, in the winter year of commissioning and in summer 15 years after commissioning.

O/2013/0397/F Wind turbine

126. This application is the erection of wind turbine (57.8m tip height) with switch room located approximately 0.3 km from the proposed interconnector at its closest point.

Cumulative Landscape Character Effects

127. The height of the turbine and its location near Tower 61 of the Tyrone – Cavan Interconnector mean it is likely to be visible within some sections of the drumlin landscape by some receptors. It will be located on elevated ground approximately 367m east of 12 Tullycallidy Road, Armagh and will introduce another man made vertical feature into the landscape.

LCA 66: Armagh Drumlins

128. Landscape character sensitivity is assessed as High for the Armagh Drumlins LCA and between Towers 62 and 71 sensitivity of the physical landscape is considered to be Medium – High.

129. There would be no perceptible change to character experienced in parts of this LCA when the Tyrone – Cavan Interconnector is considered in combination with the Wind Turbine and the magnitude of change ratings would be Negligible. This results in a Minor effect during construction, in the winter year of commissioning and in summer 15 years after commissioning, which is not considered Significant.

Cumulative Visual Effects

130. Viewpoints19 has been identified as having the potential for cumulative visual effects with this proposed application.

Viewpoint 19

131. Viewpoint 19 is considered to have High Sensitivity to change. The non-cumulative magnitude of change is considered to be Negligible during construction, year 1 and year 15.This viewpoint is located at Navan Fort and the landscape in this view is heavily wooded with mainly deciduous, well managed, small blocks. From this location, there is screening from mature trees and the drumlin topography to the distant overhead line and views of the Tyrone – Cavan Interconnector have been assessed as barely perceptible.

132. A group of 6 overhead line towers (towers 62 – 67) adjacent to the site of the turbine application would appear to the south of the view amongst existing woodland, although these towers are particularly difficult to discern as they would be smaller elements within the overall view and would be nestled behind intervening woodland with only the tops actually visible.

133. The turbine, would introduce a light coloured moving object which would be discernible on the horizon. The cumulative change in view would be slight and over a very limited area. Taking this into account the cumulative magnitude of change is considered to be Negligible. This results in a Minor effect during construction, in the winter year of commissioning and in summer 15 years after commissioning, which is not considered significant.

0/2013/0259/F Wind turbine

134. This is an application for a single wind turbine on a tubular tower of up to 41.5m height with blades up to 55m tip height. The application is located approx.152m SW of 48 Dernalea Road, Tamlaght, Armagh BT60 4EA and is located to the west of the line in the vicinity of Tower 71 and Tower 72 of the proposed Tyrone – Cavan Interconnector.

Cumulative Landscape Character Effects

LCA 66: Armagh Drumlins

135. Armagh Drumlins LCA is considered to have High Sensitivity to change. The non-cumulative magnitude of change is considered to be Medium - High during construction, year1 and year15. The erection of

the consented scheme would introduce elements that are not uncharacteristic of this LCA. The cumulative magnitude of change would result in a very small effect to a very localised area. The overall LCA would be largely unaffected when the Tyrone – Cavan Interconnector is considered in combination with the application. The cumulative magnitude of change would therefore be considered Negligible. The resulting cumulative impact would therefore be Minor Adverse during construction, in the winter year of commissioning and in summer 15 years after commissioning for the Armagh Drumlins LCA.

Cumulative Visual Effects

136. Viewpoint 20 has been identified as having the potential for cumulative visual effects with this proposed application.

Viewpoint 20

137. This viewpoint looks along the A3 which is an open landscape, slightly elevated with panoramic views across the gently rolling countryside. Hedges and mature trees are common features scattered across the landscape following roadsides and field boundaries. The combination of several distant undulations of drumlin landscape has a levelling effect and the horizon appears relatively flat as a result.

The sensitivity is considered to be Medium for this viewpoint location

The construction activities for the overhead line would be clearly visible and the non-cumulative magnitude of change is assessed as High resulting in impacts of Moderate - Major Adverse during construction.

During Year Operational Year 1 and Year 15, the non-cumulative magnitude of change relating to the overhead line and towers would reduce to Medium - High resulting in impacts of Moderate Adverse in year 1 after commissioning.

The introduction of Turbine application O/13/0259/F would occupy the western edge of the view in the middle distance where the turbine and moving blades would be viewed to the right of Tower 72 and in conjunction with the overhead line. When considered in the overall Viewpoint 20, this would result in Medium cumulative magnitude of change during construction, in the winter year of commissioning and in summer 15 years after commissioning.

The cumulative effect arising from the introduction of the turbine in conjunction with the proposed overhead line would therefore be Moderate.

Impact of Application O/2013/0397/F and O/2013/0259/F on Properties

<u>O/2013/0397/F Wind turbine</u>

138. Several properties have been identified as having the potential for cumulative visual effects with the approved application erection of wind turbine. Of the properties assessed in the non-cumulative individual properties assessment (Section 13.6.2.2. Chapter 13 Landscape and Visual) the following properties lie within 500m of this proposal F33. Individual properties F31 and F31+ lie just outwith the 500m buffer, however, due to their elevated nature and potential views to the turbine, have been included within this assessment.

139. Each of these properties is assessed as having a High sensitivity.

140. For property F31, the non-cumulative magnitude of change during construction and operation was assessed as High, resulting in Major Adverse effects.

141. When considered in combination with the proposed wind turbine, the cumulative magnitude of change is considered to be High - Medium during construction and operation due to the turbine being located in an elevated location, the introduction of a moving object and vertical structure which would be seen in conjunction with the overhead lines and towers. The cumulative effect therefore would be Moderate – Major during construction in the winter year of commissioning and in summer 15 years after commissioning.

142. For properties F31+ and F33, the non-cumulative magnitude of change was assessed as High – Medium during construction, winter year of commission and in summer 15 years after commissioning. When the Tyrone – Cavan Interconnector is considered in combination with the wind turbine application, the cumulative magnitude of change is considered to be High - Medium. The turbine would

introduce a vertical man made structure and movement on an elevated location, which would be visible above the local topography and be seen in the context of the Tyrone – Cavan Interconnector. The cumulative effect, arising from the introduction of the turbine, during construction, in the winter year of commissioning and in summer 15 years after commissioning, is considered to be Moderate – Major.

O/2013/0259/F Wind turbine.

143. Several properties have been identified as having the potential for cumulative visual effects with the approved application erection of wind turbine. Of the properties assessed in the non-cumulative individual properties assessment (Section 13.6.2.2. Chapter 13 Landscape and Visual) the following properties lie within 500m of this proposal G33, G34 and H5 along with newly identified receptor G34+ (March 2015).

144. Each of these properties is assessed as having a High sensitivity.

145. For property G33, the non-cumulative magnitude of change during construction was assessed as High – Medium and would remain High – Medium during operation, resulting in Moderate –Major Adverse effects during construction and during operation.

146. When considered in combination with the proposed wind turbine, the cumulative magnitude of change is considered to be Medium during construction and operation due to the turbine being located in an elevated location with partial screening provided by vegetation and the oblique nature of views of the turbine. The cumulative effect therefore would be Moderate Adverse during construction in the winter year of commissioning and in summer 15 years after commissioning, which is considered Significant.

147. For property G34, the non-cumulative magnitude of change was assessed as Low -Medium during construction, winter year of commission and in summer 15 years after commissioning resulting in Moderate Adverse effects. When the Tyrone – Cavan Interconnector is considered in combination with the wind turbine application, the cumulative magnitude of change is considered to be Moderate. The turbine would introduce a vertical man made structure and movement on an elevated location, which would be visible above the local topography and be seen in the context of the Tyrone – Cavan Interconnector. There would be Moderate cumulative effect, arising from the introduction of the turbine, during construction, in the winter year of commissioning and in summer 15 years after commissioning.

148. For newly identified receptor G34+ , the non-cumulative magnitude of change during construction as assessed as Low – Negligible and would remain Low – Negligible during operation in winter year of commission and in summer Year 15. This would result in Minor – Moderate Adverse effects.

149. When considered in conjunction with wind turbine application O/2013/0259/F the cumulative magnitude of change is considered to be Low – Negligible due to the screening provided by adjacent buildings, vegetation and oblique nature of views of the turbine in conjunction with the proposed overhead line.

150. The cumulative effect arising from the application is considered to be Minor – Moderate.

5.3.7.8 Summary

151. With regard to Landscape and Visual impacts, cumulative impacts of consented schemes when considered in combination with The Tyrone - Cavan Interconnector are predicted be Imperceptible on Landscape Character Areas. .

152. It is considered that there would be significant adverse cumulative effects on four residential receptors, arising from wind turbine applications in combination with the Tyrone – Cavan Interconnector as listed below.

153. When O/2013/0397/F Wind turbine and switch room is considered in combination with the proposed Tyrone – Cavan Interconnector, three residential receptors F31, F31+ and F33 have been assessed as having Moderate – Major cumulative effects arising from 0/2013/0397/F Wind turbine.

154. When 0/2013/0397/F Wind turbine – Single Wind Turbine is considered in combination with the proposed Tyrone – Cavan Interconnector, residential receptor G33 has been assessed as having Moderate cumulative effects arising from 0/2013/0259/F Wind turbine.

155. The cumulative effect arising from the introduction of the turbine 0/2013/0397/F in conjunction with the proposed overhead line would give rise to Moderate effects on Viewpoint 20 arising from the turbine.

Dwellings

156. Of the dwellings assessed in the non-cumulative individual dwellings assessment (Section 13.6.2.2. Chapter 13 Landscape and Visual of the Consolidated ES), the following dwellings lie within 500m of the proposed wind turbine application[66]: J6, J7, J8, J13, J14, J15, J16, J18, J19, J20, J22, J23, J25, J25+, J26. Each of these dwellings has been assessed as having a High sensitivity.

157. For dwelling J6 the non-cumulative magnitude of change for construction and operation is considered to be Low. The magnitude of change when the Tyrone-Cavan Interconnector is considered in combination with the O/2013/0157/F wind turbine would be Negligible, resulting in Minor Adverse during construction, in the winter year of commissioning and in summer 15 years after commissioning.

158. For dwelling J7, the non-cumulative magnitude of change is considered to be High-Medium. From the rear of the dwelling the tips of the turbine may be visible in combination with the proposed overhead line of the Tyrone-Cavan Interconnector from upper windows. The cumulative magnitude of change is considered to be Low-Negligible resulting in **Minor – Moderate** (see Table 5.2) cumulative effects during construction, in the winter year of commissioning and in summer 15 years after commissioning.

159. For dwelling J8, the non-cumulative magnitude of change is considered to be Negligible. When the turbine is considered in conjunction with the Tyrone-Cavan Interconnector, the cumulative magnitude of change increases slightly to Low – Negligible, resulting in **Minor – Moderate** (see Table 5.2) effects during construction and operation.

160. For dwelling J13, the non-cumulative magnitude of change is considered to be High-Medium resulting in Moderate to Major adverse effects. The introduction of the turbine will appear in a small portion of oblique views from this receptor, therefore the cumulative magnitude of change is considered to be Low, resulting in **Minor** effects during construction and operation.

161. For dwelling J14, the non-cumulative magnitude of change is High – Medium resulting in Moderate to Major adverse effects. The introduction of the turbine, in combination with the Tyrone-Cavan Interconnector would have a High magnitude of change. The cumulative effects would increase to **Major** (see Table 5.2) during construction, in the winter year of commissioning and in summer 15 years after commissioning.

162. For dwellings J15 and J19 the non-cumulative magnitude of change is Low-Negligible. Given distance, screening and orientation of windows, the cumulative magnitude of change resulting from the introduction of the turbine is considered Negligible. The predicted cumulative effects are therefore **Minor** (see Table 5.2) during construction. During operation the cumulative impact will be **Imperceptible** (see Table 5.2).

163. For dwelling J16, the non-cumulative magnitude of change is High, resulting in Major Adverse impacts during construction and operation. The turbine would be viewed in close proximity to the receptor and bring about an intensive change to the immediate view. It would sit in behind the Tyrone-Cavan Interconnector which would also be visible. The introduction of the turbine would result in a High cumulative magnitude of change, and therefore the cumulative effects arising from the turbine will be **Major** (see Table 5.2), during construction, in the winter year of commissioning and in summer 15 years after commissioning.

164. For dwelling J18 the non-cumulative magnitude of change is considered Medium, resulting in Moderate – Major Adverse effects. The introduction of the turbine will result in a Low magnitude of change giving **Moderate** (see Table 5.2) cumulative effects during construction, in the winter year of commissioning

[66] As outlined in Chapter 13 (Landscape and Visual) of the Consolidated ES, extensive field study of the characteristics of the landscape has shown that due to the scale and topography of the drumlin landscape type that dominates the route, properties that lie within 500m of the overhead line route are more likely to have clear views of the proposals.

and in summer 15 years after commissioning.

165. For dwelling J19 the non-cumulative magnitude of change is Low-Negligible. Given distance, screening and orientation of windows, the cumulative magnitude of change resulting from the introduction of the turbine is considered Negligible. The predicted cumulative effects are therefore **Minor** (see Table 5.2) during construction and operation.

166. For dwelling J20 the non-cumulative magnitude of change for construction and operation is considered to be Low. The magnitude of change when the Tyrone-Cavan Interconnector is considered in combination with the O/2013/0157/F wind turbine would be Negligible, resulting in **Minor** (see Table 5.2) during construction, in the winter year of commissioning and in summer 15 years after commissioning.

167. For dwelling J22, the non-cumulative magnitude of change is Medium resulting in Moderate – Major Adverse effects. The introduction of the turbine, in combination with the Tyrone-Cavan Interconnector overhead line would have a High magnitude of change. The turbine would be viewed in close proximity to the receptor and bring about an intensive change to the immediate view. It would appear in front of the Tyrone-Cavan Interconnector and would also be visible within the same view. The cumulative effects would increase to **Major** (see Table 5.2) during construction, in the winter year of commissioning and in summer 15 years after commissioning.

168. For dwelling J23 the non-cumulative magnitude of change is considered Medium – Low resulting in Moderate – Minor Adverse effects. The introduction of the turbine will result in a noticeable change to a limited area and when viewed in combination with the Tyrone-Cavan Interconnector would result in a Medium cumulative magnitude of change giving **Moderate – Major** (see Table 5.2) cumulative effects during construction, in the winter year of commissioning and in summer 15 years after commissioning.

169. For dwelling J25 the non-cumulative magnitude of change is considered Low, resulting in Moderate Adverse effects arising from the Tyrone-Cavan Interconnector. The cumulative magnitude of change is Low-Negligible. Given distance, screening and orientation of windows, the cumulative effect resulting from the introduction of the turbine is considered **Imperceptible** (see Table 5.2).

170. For dwelling J25+ the non-cumulative magnitude of change is considered Low, resulting in Moderate Adverse effects arising from the Tyrone-Cavan Interconnector. The cumulative magnitude of change is Negligible. Given distance, screening and orientation of windows, the cumulative effect resulting from the introduction of the turbine is considered Minor Adverse and **Imperceptible**.

171. For dwelling J26 non-cumulative magnitude of change is Low-Negligible. The introduction of the turbine is considered to have a Negligible cumulative magnitude of change and there would be **Minor** (see Table 5.2) cumulative effects.

5.3.7.9 O/2009/0807/F Erection of 1 No. free range organic chicken house

172. This application is located near Brootally Road, Milford and is located directly adjacent to Tower 66.

Cumulative Landscape Character Effects

LCA 66: Armagh Drumlins

173. Armagh Drumlins LCA is considered to have High Sensitivity to change. The non-cumulative magnitude of change is considered to be Medium - High during construction, Year 1 (year of commissioning) and Year 15 (and future design year). The erection of the consented scheme would be a similar development to other chicken houses that occur in the area of this LCA. The cumulative magnitude of change would result in a very small effect to a very localised area. The overall LCA would be largely unaffected when the Tyrone-Cavan Interconnector is considered in combination with the application. The cumulative magnitude of change would therefore be considered Negligible. The resulting cumulative impact would therefore be Minor Adverse during construction, in the winter year of commissioning and in summer 15 years after commissioning for the Armagh Drumlins LCA.

Cumulative Visual Effects

174. No Viewpoints have been identified as having the potential for cumulative visual effects with this approved application.

Dwellings

175. Several dwellings have been identified as having the potential for cumulative visual effects with the approved application O/2009/0807/F 1no. chicken house. Of the dwellings assessed in the non-cumulative individual dwellings assessment (Section 13.6.2.2. Chapter 13 Landscape and Visual of the Consolidated ES) the following dwellings lie within 500m of the approved application: G9, G10 and G12. Each of these dwellings has been assessed as having a High sensitivity.

176. Screening from associated agricultural buildings for each of the above, results in no view of the cumulative effect. For dwellings, G9, G10 and G12 the non-cumulative magnitude of change for construction and operation is considered to be below Negligible. The magnitude of change would not increase when the Tyrone-Cavan Interconnector is considered in combination with the application O/2009/0807/F resulting in No Cumulative Effect during construction, in the winter year of commissioning and in summer 15 years after commissioning (**Imperceptible** - see Table 5.2).

5.3.7.10 Overall Cumulative Assessment

177. In considering the effect of the Tyrone - Cavan Interconnector, in terms of landscape and visual, and potential interactions and cumulative effects associated with all development proposals (as listed in section 5.2.3 and any potential cumulative impacts between all the listed projects), it is concluded that there would be no further cumulative landscape and visual impacts beyond those identified above.

5.3.8 Community Amenity and Land Use

178. It has been determined that there are no other developments which could have significant cumulative impacts to Community Amenity and Land Use, because of the distance, scale and nature of the other developments. Also, as the proposed interconnector avoids community sites there will be no significant cumulative impacts (**Imperceptible**).

179. The assessment of agricultural impacts is largely based on a 60m corridor from the centreline from the overhead line and towers. For the purpose of this cumulative assessment, within the 60m corridor between Towers 102 and 107 (the immediate border section where any possible impacts are likely to occur) there are four land parcels within Northern Ireland (reference 165, 176, 177 and 145&146 – the latter is one parcel) and seven within the Republic of Ireland (reference numbers LCT001, LCT002, LCT003, LCT004, LCT005, LCT007 & LCT008A). On land parcel LCT008A, the parcel is oversailed by the overhead line and a tower (North-South 400 kV Interconnection Development) is located within the parcel. In addition, there is a farm yard within 25 meters from the border and thus is within the 60m corridor of the Tyrone - Cavan Interconnector). The cumulative impact to Land Parcel LCT008A is **Minor**.

180. Overall, it is considered that the cumulative impact to agricultural land use from the proposed interconnector will not have a significant cumulative impact on agriculture because of the scale of the impacts **(Imperceptible)**.

181. Cumulative impacts of other proposed overhead line developments have been considered. The Tamnamore to Omagh proposed overhead line will be located approximately 1.6km north east of tower 10. It does not impact on any of the land parcels affected by the Tyrone - Cavan Interconnector and therefore there is no cumulative impact **(Imperceptible)**.

182. Other developments will not have a significant cumulative impact on agriculture because of the distance and scale of the proposals **(Imperceptible)**.

183. In considering the effect of the Tyrone - Cavan Interconnector, in terms of community amenity and land

use, and potential interactions and cumulative effects associated with other development proposals (as listed in section 5.2.3 and any potential cumulative impacts between all the listed projects), it is concluded that the potential cumulative community amenity and land use impacts are **Imperceptible.**

5.3.9 Socio-economics

184. There are no known proposals of a similar scale, or smaller proposals, that could have a significant cumulative impact on tourism in the area. It has been determined that there are no other developments which could have significant cumulative impacts due to the distance, scale and nature of the other developments.

185. In considering the effect of the Tyrone - Cavan Interconnector, in terms of socio-economics, and potential interactions and cumulative effects associated with other development proposals (as listed in section 5.2.3 and any potential cumulative impacts between all the listed projects), it is concluded that the potential cumulative socio-economics impacts are **Imperceptible.**

186. In terms of economic impacts, studies by SONI and EirGrid have shown the proposed interconnector will help customers on the island of Ireland to save approximately €20m[67] in 2020 and between €40m and €60m[68] by 2030[69]. This is considered to be a **Major** cumulative impact.

187. The proposed interconnector will be a significant capital infrastructure investment in Northern Ireland and in the Republic of Ireland. There will also be an employment benefit arising from required construction workers, which would impact on the construction industry. There is also an interrelated positive impact from contractors/construction workers staying in the local area, which will benefit the hospitality industry. As with the other economic benefits the cumulative impacts will be additive and possibly synergistic.

5.3.10 Telecommunications and Aviation Assets

188. The effect of the Tyrone - Cavan Interconnector has been considered in terms of telecommunications and aviation assets, and potential interactions and cumulative effects associated with other development proposals (as listed in section 5.2.3 and any potential cumulative impacts between all the listed projects). The Tyrone - Cavan Interconnector will not result in any significant impacts to telecommunications and aviation assets. The nature of the other developments poses no risk to these assets. Therefore, it is concluded that the potential cumulative telecommunications and aviation assets impacts are **Imperceptible.**

5.3.11 Flood Risk Assessment

189. In considering the effect of the Tyrone - Cavan Interconnector, in terms of flood risk, and potential interaction and cumulative effect associated with other development proposals (as listed in section 5.2.3 and any potential cumulative impacts between all the listed projects), it is concluded that there will be no cumulative effects. This includes the North-South 400 kV Interconnection Development because of the positioning of the proposed works and the scale of the impacts. This outcome is substantiated

[67] Based on the exchange rate in March 2015: £14.5m

[68] Based on the exchange rate in March 2015: £29m - £43.5m

[69] EirGrid/SONI (2015). *The Need for a Second North South Electricity Interconnector*. This paper describes the detailed calculation of associated benefits for the project. It is included as Appendix 3.1 of the Consolidated ES Addendum.

by the results of the assessment of the Tyrone - Cavan Interconnector having no significant effect and the principles of Planning Policy Statement 15 (DOE) which should appropriately manage the potential for other developments to cause impacts from other developments on flood risk to this development or elsewhere. Because of scale of the impacts and the mitigation the cumulative flood risk effects are **Imperceptible.**

5.3.12 Transport

190. The cumulative impacts of the other developments (as listed in section 5.2.3 and any potential cumulative impacts between all the listed projects) have been considered for cumulative transport impacts. The timing of construction, the proposed routes likely to be used and geographical distances from the working areas means that there are unlikely to be any significant cumulative impacts with the Tamnamore Omagh line and Tyrone - Cavan Interconnector.

191. The Tyrone - Cavan Interconnector and the North-South 400 kV Interconnection Development could be constructed at the same time; however because of geographical distances and the proposed routes likely to be used to access the working areas, there are unlikely to be any significant cumulative impacts as a result of the overall development. The other developments are not of the scale and nature to result in significant transport impacts.

192. In addition to the other developments listed in this Section, an additional search for planning applications within 5km of the proposed works was undertaken for the transportation assessment (in line with best practice – see Chapter 18 of the Consolidated ES for further details). The following two applications have been granted permission and could be of significance in terms of impact due to site development and potential accesses:

- M/2010/0870/F: - Proposed Housing Development consisting of 47 No. Dwellings (3no. Detached, 34 no. Semi-Detached and 10 Townhouses) and associated site works. The Tyrone - Cavan Interconnector is located approximately 46m North of 8-18 Clonfeacle Road Benburb, County Tyrone and over 1km west from the nearest Tower (T29); and,
- O/2012/0460/F: - Housing development and associated site works consisting of 2 no. Detached Dwellings and 8 no. Townhouses. The Tyrone - Cavan Interconnector is located at lands at 72 Maydown Road, south of the village of Benburb and over 500m west from the nearest Tower (T39).

193. In order to take account of the traffic implications, the volumes of traffic generated have been calculated and included in the traffic model (as outlined in Chapter 18 [Transport] of the Consolidated ES).

194. In considering the effect of the Tyrone - Cavan Interconnector, in terms of transport, and potential interactions and cumulative effects associated with other development proposals (as listed in section 5.2.3 and any potential cumulative impacts between all the listed projects), it is concluded that the potential cumulative transport impacts are **Imperceptible.**

5.3.13 Air Quality and Climate

195. Cumulative local air quality impacts may arise where proposed construction activity associated with other developments may occur within approximately 500m of the Tyrone – Cavan Interconnector construction sites. Furthermore, cumulative impacts may occur on roads used by construction vehicles, where increased numbers of HGVs due to other developments may increase the likelihood of local air quality impacts associated with exhaust emissions.

196. Construction activity associated with planning applications O/2009/0807/F near tower number 66, and application O/2013/0157/F near towers 95 and 96, will occur within 500m of construction work associated with the Tyrone – Cavan Interconnector. However, construction activities would be temporary, and the magnitude and significance of potential impacts would be dependent on the

duration of activities occurring nearby at the same time.

197. In considering the effect of the Tyrone - Cavan Interconnector, in terms of air quality, and potential interactions and cumulative effects associated with other development proposals (as listed in section 5.2.3 and any potential cumulative impacts between all the listed projects), it is concluded that the potential cumulative air quality impacts are **Imperceptible.**

198. With regard to cumulative climate change and greenhouse gas effects, the emissions associated with construction work are unlikely to be significant compared with the facilitated emissions reductions expected once the Tyrone – Cavan Interconnector is operational. During the operational phase the Tyrone – Cavan Interconnector will increase transmission capacity and facilitate the uptake of renewable energy sources, such as wind, by improving access to the end market, which will have overall long-term beneficial greenhouse gas and climate change effects.

5.4 Conclusions

199. An assessment of the likely significant cumulative effects of the Tyrone - Cavan Interconnector with other developments has been undertaken. Also included in the assessment is a summary of interacting effects of the Tyrone - Cavan Interconnector between assessment topics.

200. The assessment chapters in the Consolidated ES (Chapters 7 – 18) and as updated in this Addendum contain assessments of the likely significant interacting effects arising from the Tyrone - Cavan Interconnector. During the assessment process, coordination took place between assessment specialists to ensure that interacting impacts arising from the Tyrone - Cavan Interconnector were identified, assessed and, where appropriate, mitigated.

201. The assessment of cumulative impacts between the Tyrone - Cavan Interconnector and other developments has included identification of the other planned developments which have not yet been constructed. This has led to the identification of other projects such as the Tamnamore to Omagh 110 kV network reinforcement project and the North-South 400 kV Interconnection Development. Other developments also include proposed chicken sheds, housing and wind turbines.

202. A cumulative impact assessment has been undertaken of the proposed Tyrone - Cavan Interconnector and the other identified developments, both individually and cumulatively (i.e. all projects assessed together).

203. Cumulative impacts are predicted to be **Imperceptible** (or positive in the case of socio-economics) apart from the specific Landscape and Visual impacts set out below:

- Impacts between Tyrone - Cavan Interconnector and Tamnamore to Omagh 110 kV network reinforcement project on LCA 47: Loughgall Orchard Belt;
- Impacts between Tyrone - Cavan Interconnector and North-South 400 kV Interconnection Development 400 kV overhead line on LCA 66: Armagh Drumlins, LCA 6: Mullyash Uplands, Viewpoint 30, Viewpoint 34;
- Impacts between Tyrone - Cavan Interconnector and North-South 400 kV Interconnection Development 400 kV overhead line on Individual Dwellings J48, J51, J51+, J59, J60 and J61;
- Impacts between Tyrone - Cavan Interconnector and O/2013/0464/F Wind turbine on residential receptor E20; and,
- Impacts between Tyrone - Cavan Interconnector and O/2013/0157/F Wind turbine on residential receptors J14, J16, J22 and J18.

204. In addition, there will be a **Minor** cumulative impact to one farm located at the border (Community Amenity and Land Use impacts) between the Tyrone – Cavan Interconnector and the North-South 400 kV Interconnection Development.

205. In terms of economic impacts, studies by SONI and EirGrid have shown the proposed interconnector will help customers on the island of Ireland to save approximately €20m[70] in 2020 and between €40m and €60m[71] by 2030[72]. This is considered to be a **Major** cumulative impact.

206. The proposed interconnector will be a significant capital infrastructure investment in Northern Ireland and in the Republic of Ireland. This will benefit both economies, and will be a positive additive effective which could be synergistic. There will also be an employment benefit arising from required construction workers, which would impact on the construction industry. This impact will also be additive and possibly synergistic. There is also an interrelated positive impact from contractors/construction workers staying in the local area, which will benefit the hospitality industry. As with the other economic benefits the cumulative impacts will be additive and possibly synergistic.

5.5 References

Design Manual for Roads and Bridges. 2008. Volume 11, Section 2, Part 5: HA 205/08 Assessment and Management of Environmental Effects.

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Department of the Environment. 2012. Development Control Advice Note (DCAN 10) Environmental Impact Assessment.

European Commission. 1999. Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions.

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Office of the Deputy Prime Minister. 2000. Environmental Impact Assessment: Guide to Procedures.

[70] Based on the exchange rate in March 2015: £14.5m

[71] Based on the exchange rate in March 2015: £29m - £43.5m

[72] EirGrid/SONI (2015). *The Need for a Second North South Electricity Interconnector*. This paper describes the detailed calculation of associated benefits for the project. It is included as Appendix 3.1 of the Consolidated ES Addendum.

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Chapter 6 Transboundary Impact Assessment



Main Text Volume 2

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6 Transboundary Impact Assessment

NB This text supersedes Chapter 20 Transboundary Impacts of the published Consolidated ES (May 2013). The assessment has been updated and has had regard to the published North-South 400 kV Interconnection Development (June 2015). In addition, to the transboundary assessment within the Consolidated ES and EIS, a Joint Environmental Report (see Section 2 of this report) has been prepared.

6.1 Introduction

1. Part VI of the EIA Regulations sets out specific requirements governing development likely to affect other European Union Member States. In sum, these requirements specify that where effects are likely Member States should be informed and given the opportunity to participate in the planning process within the jurisdiction of any proposed projects.

2. This is relevant to the Tyrone - Cavan Interconnector, which, comprising the Northern Ireland portion of the proposed interconnector, is likely to have effects within the Republic of Ireland. To this end this Section provides a summary of likely environmental effects on other Member States (more commonly called "transboundary impacts") determined as part of the EIA for the Tyrone - Cavan Interconnector.

3. This Section is intended to be a summary of the transboundary impacts. Full details of the impact assessment are contained in the other Chapters of the Consolidated ES as relevant. The EIA of the Tyrone - Cavan Interconnector has been based on an assessment of the likely significant impacts and as such has included receptors and impacts within the Republic of Ireland, as required by the EIA Regulations, regardless of jurisdiction. It is therefore recommended that the entirety of the Consolidated ES and this Addendum should be read in order to gain a full appreciation of the transboundary (and all other) impacts.

4. It should be noted that transboundary impacts arising from EirGrid's proposals for construction of a continuing overhead line that portion of the proposed interconnector within the Republic of Ireland (i.e. the North-South 400 kV Interconnection Development) have been reported separately through a separate Environmental Impact Statement (EIS) (published June 2015); this should be referred to in considering potential impacts in the Republic of Ireland.

5. In addition, to the transboundary assessment within the Consolidated ES and EIS, a Joint Environmental Report (see Section 2 of this report) has been prepared.

6.2 EMF

6. Control of Electric and Magnetic Fields (EMFs) in both Northern Ireland and in the Republic of Ireland is based on the same exposure limits, the 1998 ICNIRP limits as adopted in the 1999 EU Recommendation. The proposed overhead line is separately compliant with these limits on both sides of the border, and EMFs emitted across the border will likewise comply with the ICNIRP and EU guidelines on exposure of the general public to EMF. There will therefore be no significant transboundary EMF impacts.

6.3 Water Environment

7. The River Basin District (RBD - defined by the Water Framework Directive [WFD]) through which the Tyrone - Cavan Interconnector is routed is the Neagh Bann international RBD with watercourses and surface runoff flowing in a generally northerly direction. Within the trans-boundary region the overhead line spans a small number of surface watercourses; the nearest tower (EirGrid Tower 106) is approximately 10m away from an unnamed tributary of Clontibret Stream. Towers are generally located away from watercourses. The WFD classification for the watercourse in this area is predominantly poor ecological status.

8. The tributary of the Clontibret Stream originates south of the border, flowing along it for a short stretch close to tower 102, before flowing through the Republic of Ireland for a few kilometres before returning back into Northern Ireland and ultimately the River Blackwater. No direct effects to this stream will occur as a consequence of this development. Development of Towers 99-102 are in areas where runoff drains to a tributary of this stream. However, all of these sites have been assessed and no adverse effects are predicted, with the implementation of mitigation measures as set out in the Consolidated ES and EIS. Therefore, there will be no significant transboundary effects on the surface water environment as a result of the Tyrone - Cavan Interconnector.

6.4 Soils, Geology and Groundwater

9. Impacts on soils, geology and groundwater are site-specific and would be limited to the immediate area of the proposed towers. Accordingly, it is considered that any effects on the ground and groundwater conditions arising from the construction of the southernmost towers 98 to 101, closest to the boundary with the Republic of Ireland, would not extend across the border. Tower 102 is located approximately 100m from the border. However, it is considered highly unlikely that the construction of the tower will pose a risk of a significant impact on the geology and groundwater conditions in the Republic of Ireland. It is concluded that the Tyrone - Cavan Interconnector would have no likely significant transboundary effects on these features.

6.5 Ecology

10. There will be no transboundary impacts as a result of the Tyrone - Cavan Interconnector on habitats. The Tyrone - Cavan Interconnector has no direct land take within the Republic of Ireland and the potential for indirect effects through an increase in sediment load in watercourses or discharge of pollutants is minimised through the implementation of mitigation measures during construction as detailed in the Consolidated Environmental Statement.

11. There will be no Transboundary impacts on badgers or otters as home ranges of either species in the Republic of Ireland will not be displaced or affected as a direct or indirect result of construction or operation of the Tyrone - Cavan Interconnector.

12. There will be no Transboundary impacts on bats during the breeding or hibernation season in the Republic of Ireland as home range habitats will not be affected as a direct or indirect result of construction or operation of the Tyrone - Cavan Interconnector. There is some potential for Transboundary impacts upon migrating bats if construction work displaces any commonly used routes. Should this be the case the impact will be temporary and on a small spatial scale with displacement minimal. There will be no Transboundary impacts on bats during operation and the potential for impacts during construction is considered negligible.

13. There will be no Transboundary impacts on smooth newts as a result of the Tyrone - Cavan Interconnector. Smooth newts do not regularly disperse more than 500m from a breeding pond and therefore there is no potential for Transboundary impacts because of the distance of such possible habitats from the Tyrone - Cavan Interconnector.

14. There is a potential collision risk during the migration period for whooper swans that spend the majority of the winter period within the Republic of Ireland. The risks associated with collision have been assessed as negligible through extensive fieldwork and assessment of swan movements. This has been further minimised through the incorporated mitigation measure of adding spiral deflectors to the earth wires in those areas deemed highest risk. Swans on migratory flights would in general be at flight height that would not put them at risk of collision and the fleeting time that would be spent in the proximity of the Tyrone-Cavan Interconnector during migration passage further reduces the risk.

15. There is no potential for transboundary impacts on breeding birds due to the relatively small breeding territory size of species recorded and a lack of displacement expected as part of the Tyrone - Cavan Interconnector.

16. For the reasons stated it has been assessed that the there are no likely significant transboundary ecology impacts.

6.6 Noise

17. Because of the distance from the nearest receptors in the Republic of Ireland and the nearest proposed working area, there will be no significant transboundary noise or vibration impacts during construction. The predicted noise levels produced by work along the overhead line route within County Armagh will not cause the World Health Organisation (WHO) guidelines to be exceeded at any dwelling within County Monaghan.

18. Sections of the overhead line route at towers 100, 101 and 102 (Derrynoose Road, Doohat Road) are located close to the border. An existing farm dwelling is located in excess of 250m to the west of tower 102 on the County Monaghan side of the border. From the predicted noise levels, it has been determined that no significant noise impact will be present due to the operation of the overhead line route. The predicted noise levels produced by overhead line route within County Armagh will not cause the WHO guidelines to be exceeded at any dwelling within County Monaghan.

19. All other dwellings on the County Monaghan side of the border are further away and benefit from increased attenuation due to distance.

6.7 Cultural Heritage

20. Data on the Record of Monuments and Places (RMP) (www.archaeology.ie) have been reviewed for a study area of seven kilometres from the Tyrone - Cavan Interconnector. The seven kilometre study area was requested by the Department of Environment, following a consultation response from Monaghan County Council, in a Regulation 15 request in October 2010.

21. Seventy-three sites have been identified within the defined study area (see Figure 12.15 of the Consolidated ES, reproduced in the Figures section of this report). These sites span from the earlier prehistoric through to the post-medieval period. None of the sites are Areas of Archaeological Potential or have designated protection other than that conferred from being listed on the RMP.

22. The majority of the assets are raths and souterrains dating to the Early Christian period, while megalithic tombs and a standing stone are also recorded. Further sites comprise enclosures and earthworks, mainly identified from aerial photographic surveys. It is likely that these date from either the later prehistoric or Early Christian periods although alternative dates cannot be ruled out. A number of church and graveyard sites are also present within the study area. The site of a battle at Clontibret, fought in 1595, is located to the east of the village of the same name.

23. The sites analysed should be considered alongside the sites within Northern Ireland as interrelated sites rather than as separate and discreet entities. The site types found within County Armagh include raths, standing stones, megalithic tombs, churches and holy wells. These correlate with the site types found within the Republic of Ireland. These sites would not have been separated by a border and

would have been linked along lines such as geographic, geological and environmental factors, as well as social and cultural interrelationships.

24. There will be no physical impact on any of the cultural heritage sites within the Republic of Ireland by the Tyrone - Cavan Interconnector.

25. The sites within the extended seven kilometre study area range in value between low and medium. The impacts arising from the erection of the overhead line in Northern Ireland on cross border sites are considered to be limited due to the height of the proposed towers, associated lines and the distances to these sites. Those assets closest to the border are either located close to developments which have already affected their setting, screened due to intervening topography or where the setting of the assets do not contribute to their significance. The overhead line tower structures are unlikely to be prominent or become focal points at distances of 5km or greater due to reduced perceptibility[73]. Therefore further assessment of individual sites is not necessary.

26. As there are no significant transboundary impacts anticipated, the significance of impact is considered to be neutral.

6.8 Landscape and Visual

27. The Tyrone - Cavan Interconnector is intended to connect to an overhead line that is being promoted separately by EirGrid (i.e. the North-South 400 kV Interconnection Development). The overhead lines would connect across the border between Northern Ireland (Armagh Drumlins LCA) and the Republic of Ireland (Mullyash Uplands LCA).

Transboundary Landscape Impacts

28. The Tyrone - Cavan Interconnector is confined to Northern Ireland and therefore there are no resulting physical transboundary landscape effects in the Republic of Ireland. Landscape Character Areas (LCAs) within the Republic of Ireland that lie within 5km of the Tyrone - Cavan Interconnector have the potential to experience landscape character effects as a result of the SONI proposals and the assessment from these LCAs therefore represents the transboundary landscape character assessment.

29. The transboundary LCAs are Blackwater Valley and Drumlin Farmland LCA and the Mullyash Uplands LCA and landscape character effects have been assessed for these LCAs within Chapter 13 Landscape and Visual of the Consolidated ES and summarised below:

- LCA 6: Mullyash Uplands - Landscape character impacts of the proposed overhead line and towers would be **Moderate Adverse** during construction, in the winter year of commissioning and in summer 15 years after commissioning; and,
- LCA 2: Blackwater Valley and Drumlin Farmland - Landscape character impacts of the proposed overhead line and towers would be **Minor Adverse** during construction, in the winter year of commissioning and in summer 15 years after commissioning.

Transboundary Visual Impacts

30. Visual receptors that lie within the Republic of Ireland have the potential to experience visual effects as a result of the Tyrone - Cavan Interconnector and the assessment of these receptors therefore represents the transboundary visual assessment.

[73] It has been determined that beyond 5km, vegetation, local variations in topography, inclement weather and lighting will shield or partially interrupt or obscure views of the Tyrone – Cavan Interconnector. In addition, at distances of 5km or greater, the tower structures are unlikely to be prominent features or become focal points within views due to reduced perceptibility.

31. Receptors that are considered transboundary receptors are summarised as follows.

Viewpoints

- Viewpoint 30: Crossbane Road - Visual impacts of the proposed overhead line and towers would be **Moderate Adverse** during construction, in the winter year of commissioning and in summer 15 years after commissioning.
- Viewpoint 32: Minor road north-east of Castleshane - Visual impacts of the proposed overhead line and towers would be **Negligible** during construction, in the winter year of commissioning and in summer 15 years after commissioning.
- Viewpoint 33: Scenic view from Tullybuck (Clontibret) - **No Impact** has been assessed during construction, in the winter and in summer of the year of commissioning.
- Viewpoint 34: Mullyash Mountain - Visual impacts of the proposed overhead line and towers would be **Minor Adverse** during construction, in the winter year of commissioning and in summer 15 years after commissioning.

Settlements

32. There are no settlements within the Republic of Ireland that lie within the 5km study area of the Tyrone - Cavan Interconnector.

Individual Dwellings

33. Dwelling receptors within the Republic of Ireland that lie within the 500m study area of the Tyrone - Cavan Interconnector have the potential to experience visual effects and the assessment of these receptors therefore represents the transboundary assessment of individual dwellings. Dwelling receptors that are considered transboundary receptors located in the Republic of Ireland have the potential to be influenced by the proposed SONI overhead line and towers. There are dwellings identified as J50, J51, J51+, J52 and J62. For each of the following dwellings, J50, J51, J51+, J52 the visual impacts of the proposed overhead line and towers would be Moderate – Major Adverse during construction, in the winter year of commissioning and in summer 15 years after commissioning. For individual dwelling receptor J62, the impacts have been assessed as Major Adverse during construction and Moderate – Major Adverse in the winter year of commissioning and in summer 15 years after commissioning.

34. The Consolidated ES (Chapter 13 Landscape and Visual) presents the detailed assessment of these dwellings.

Transport Corridors and Paths

35. The Monaghan Way, R214, N2 and R184 are all situated in the Republic of Ireland and within 5km of the Tyrone - Cavan Interconnector.

Monaghan Way

36. When close to Viewpoint 32 or on sections of the road named Lemgare, the magnitude of change would be **Medium - High** during construction, in Year 1 and in Year 15. When considering the entire section of route that lies within the study area, however, the overall magnitude of change is considered to be **Medium - Low** during construction in Year 1 and in Year 15.

37. The impacts, therefore, would be **Minor - Moderate Adverse** during the construction period in the winter year of commissioning and in summer 15 years after commissioning.

R214

38. The B3/R214 runs in an east to west direction between Monaghan and Keady. Viewpoint 27 is located near Derrynoose Church along the B3 as the road crosses the path of the overhead line. The B3/R214 is considered to be of **Medium** sensitivity.

39. The B3 crosses the proposed overhead line route near Derrynoose Church. When at this location or when within approximately 4-500m to the west of this location the magnitude of change would be **High** during construction and **Medium – High** in Year 1 and Year 15. The ZTV shows limited theoretical visibility along the section of R214 that lies within the study area.

40. Taking this into account, the overall magnitude of change is considered to be **Low - Medium** during construction, Year 1 and Year 15 for this route. The overhead line visual impacts, therefore, would be **Minor - Moderate Adverse** during construction and in the winter year of commissioning and remain **Minor - Moderate Adverse** in summer 15 years after commissioning.

N2

41. The ZTV shows that theoretical visibility is limited to patches close to Clontibret and Tullybuck although in reality much of this section of road lies in cutting and views towards the Tyrone - Cavan Interconnector would be oblique glimpses experienced at high speeds. The magnitude of change is considered to be **Negligible** during construction, Year 1 and Year 15 and the resulting impacts of the proposed overhead line and towers would be **Negligible** during construction, in the winter year of commissioning and in summer 15 years after commissioning.

R184

42. The ZTV shows theoretical visibility along much of the section of road that lies within the study area. At distances of between 3.8km and 5km the proposed overhead line towers would be barely distinguishable and the magnitude of change is considered to be **Negligible** during construction, Year 1 and Year 15. The resulting impacts of the proposed overhead line and towers would be **Negligible** during construction, in the winter year of commissioning and in summer 15 years after commissioning.

6.9 Community Amenity and Land Use

43. The towers in Northern Ireland will be at such a distance from community receptors in County Monaghan that impacts from landscape and visual, traffic, noise and EMF would not be significant.

44. There are seven land parcels in the Republic of Ireland that are in the vicinity of the border crossings at Doohat or Crossreagh and Crossbane (reference numbers LCT001, LCT002, LCT003, LCT004, LCT005, LCT007 & LCT008A – see Figure 6.1 of this Addendum). On land parcel LCT008A there is a farm yard within 25 metres of the Tyrone - Cavan Interconnector. The impacts, from the overhead line in Northern Ireland on land parcels LCT001 and LCT007 are Negligible and the impact on LCT008A is Slight Adverse. There are no other likely transboundary Community Amenity and Land Use impacts.

6.10 Socio – Economics

45. The Armagh/Monaghan border area is not in one of the Northern Ireland Tourism Board's (NITB) established tourism regions and there are no available NITB statistics.

46. According to Tourism Ireland's publication, 'Facts & Figures 2011 - Island of Ireland Overseas Visitors', Monaghan attracted 48,000 visitors to the whole island of Ireland in 2011. This is low compared to other regions, such as Dublin (3,805,000 visitors) and Cork (1,123,000 visitors). This would indicate that while tourism is an established part of the local economy, it is not a major economic element.

47. There are no tourism destination sites (attractions or hospitality) within 5kms of the Tyrone - Cavan Interconnector in County Monaghan. It has been assessed that beyond 5km vegetation, local variations in topography, inclement weather and lighting will shield, partially interrupt or obscure views of the proposal. Impacts to tourism in the Republic of Ireland will be indirect and limited to distant views from

public places (such as roads) and to the setting of cultural heritage sites. The Cultural Heritage assessment (Chapter 12 of the Consolidated ES) notes that no significant transboundary impacts are anticipated.

48. Due to a relative lack of visitor attractions and low visitor numbers in the border areas of Armagh and Monaghan through which the Tyrone - Cavan Interconnector passes and the magnitude of impacts, it is not anticipated that there will be any likely significant transboundary effects to tourism.

49. In terms of employment in the study area, numbers employed in the hospitality industry within the area are low compared to other regions of the Republic of Ireland. Significant job losses would not occur because of temporary construction impacts or operational impacts associated with the Tyrone - Cavan Interconnector.

50. It is thus determined that there would not be significant negative impacts on transboundary tourism or employment as a result of the Tyrone - Cavan Interconnector. There will be a positive impact during construction relating to construction investment and employment.

6.11 Telecommunications and Aviation Assets

51. No objections or potential impacts were highlighted by the telecommunication or aviation consultees. It is concluded that there are no likely significant transboundary telecommunication or aviation assets impacts.

6.12 Flood Risk Assessment

52. There is a small element (Towers 98 – 102) of the southern section of the Tyrone - Cavan Interconnector that is located within a catchment which drains to the south, into the Republic of Ireland. Towers 98 – 102 are located within a catchment that would drain to the west and then as a tributary of the River Blackwater (Bann catchment), returning to the north in Northern Ireland and the origins of the Tyrone - Cavan Interconnector.

53. As discussed within Chapter 18 (Flood Risk) of the Consolidated ES, there are no significant effects identified within the assessment and, hence, no anticipated transboundary effects.

6.13 Transport

54. As the Tyrone - Cavan Interconnector will not require any significant traffic movements within the Republic of Ireland, there are no transboundary effects.

6.14 Air Quality and Climate

55. The construction works within Northern Ireland will have limited dust generating potential and with the proposed mitigation measures, there will be no transboundary effects in terms of air quality. Additionally, construction traffic will not generate significant emissions.

56. During the operational phase the Tyrone – Cavan Interconnector will increase transmission capacity and facilitate the uptake of renewable energy sources, such as wind, by improving access to the end market, which will have overall long-term beneficial greenhouse gas and climate change effects. This will result in beneficial transboundary effects.

6.15 Conclusions

57. The transboundary impacts of the Tyrone - Cavan Interconnector are those impacts on receptors within the Republic of Ireland. The transboundary impacts are predicted to range from negligible to minor adverse apart from landscape impacts (on the Mullyash Uplands LCA) and visual impacts (viewpoints 30 and 31), primarily to visual receptors in close proximity to the Tyrone - Cavan Interconnector.

Chapter 7 Haulage Route Assessment



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7 Haulage Route Assessment

7.1 Introduction

7.1.1 Overview

1. Electrical equipment will be brought to site from the appropriate various manufacturers using road transport from nearby ports. Most equipment will arrive in component form and will be assembled on prepared foundations on site. Major plant items, such as Substation Gantries, Aluminium galvanised steel busbars, circuit breakers and transformers will be required at the Turleenan substation and will be more significant from a haulage perspective, with large loads coming to the substation site and the requirement for large cranes to off-load and place these items in situ.

2. An outline Construction Traffic Management Plan has been drawn up at this stage; see Consolidated ES, Chapter 18 (Transport). This plan would include the following:

    - If required, appropriate Police Service of Northern Ireland (PSNI) or contractor escort to accompany movement of components to be agreed with the Transport NI and Police where appropriate;
    - Advanced notification to the general public warning of transport movements;
    - Informative road signage warning other users of forthcoming construction traffic movements; and,
    - Provision of temporary signs and traffic control where necessary.

3. The information contained in this chapter of the Addendum and Appendix 7.1 provides additional information to the Transport Assessment contained in the Consolidated ES. This chapter focuses on the transportation of the large equipment needed for the proposed substation at Turleenan – in particular the three transformers required for the substation -– outlining how the equipment would be transported to site, its likely significant effects and the proposed mitigation measures to eliminate or minimise the impacts.

7.1.2 Warrenpoint Port to Moy

4. A Transport Study for this journey has been conducted (ALE Transport Study - Appendix 7.1). The study identified Warrenpoint Port as the closest suitable port to the substation site. Consultations with Transport NI (Transport NI) had determined that M1 from Belfast was not suitable and this ruled out Belfast Port.

5. The proposed 35 mile route the transformers will take is A2 northwest from Warrenpoint, to Newry, onto Abbey Way, Upper Water Street and Trevor Hill, the A27 and A28 (Downshire Road) through Newry then north to Armagh. The load will negotiate the tight environs of the A3 north through Armagh and will join the A29 to travel further north to Moy where it will turn right onto the B106 for its final leg to the substation.

6. The transformers weighing approximately 222 metric tonnes each will be transported initially by a 20 axle girder frame trailer. The dimensions of the transporter are 75m in length, 5.3m in width and 6.3m in height. The transporter and one transformer will weigh a total of approximately 357 metric tonnes. The weight of the transporter and a transformer will be displaced by the high number of axles and wheels, which will reduce impacts to the roads. The transporter will transport with one transformer per trip and so three trips will be required.

7. The transporter will allow the load to pass through the two bridges and under all overhead lines en-route. The load will also be capable of crossing over all route bridges safely. The load will require many manoeuvring conditions and it will be necessary to temporarily remove obstacles such as street furniture, bollards, road signs and traffic lights to allow unrestricted through access. Road safety will be maintained through temporary signals and the original street furniture will be returned as soon as possible.

8. The load will travel very slowly along its journey expecting to take between five and seven hours to reach Moy. It will be escorted by specialists to operate all manoeuvres and by the PSNI with a rolling road block throughout for traffic management. This road block would be further enforced during contraflow driving through Newry and for the reversing manoeuvre required in the centre of Armagh.

7.1.3 Moy Village to Substation

9. Due to the turning restriction of the A29, B106 junction in the centre of Moy village, the transformer load will need to be moved to a smaller self-propelled trailer to negotiate this junction, and subsequently the entrance to the substation site. From Moy the transformers will travel the remaining distance to the substation on the self-propelled trailer.

10. Consultations with Transport NI have identified that Moy is the most suitable area for the transfer because of the availability of hard standing areas (roads) close to the substation site.

11. The dimensions of the self-propelled trailer are 22m in length, 4.5m in width, 6.3m in height, 273 metric tonnes in total and 12 axles.

12. An agreement in principle with Transport NI has been reached to use a section of the A29 in central Moy to complete the transfer of the transformers to the self-propelled trailer. This is under the condition that works are only carried out in daylight hours. A temporary road closure with diversions would be required during the transfer period.

13. The transfer from the 20-axle transporter to the self-propelled trailer could take up to 15 hours due to the nature of the equipment being prepared such as mobile crane, load spreading mats, self-propelled trailer build and the split and demobilisation of the 20-axle transporter. These works would have to be split over a period of two days due to daylight working restrictions.

14. A parking restriction would be required on a section of the B106 to enable the loaded self-propelled trailer to negotiate the turn from the A29. This restricted area would be marked by ‘no parking’ cones and signs.

15. Following the transfer procedure, the 20-axle transporter will make a return trip to Warrenpoint.

7.2 Indicative Movement Programme

16. It is estimated that the transportation of a transformer will take a total of five days:

- Day 1: Mobilise to Warrenpoint Port;
- Day 2: Build 20-axle transporter;
- Day 3: Receive transformer via crane to transporter;
- Day 4: (am) Transport transformer / Prepare transfer area in Moy & build self-propelled trailer;
- Day 4: (pm) Transfer to self-propelled trailer / Deliver transformer to Moy Substation via self-propelled trailer; and,
- Day 5: De-mobilise Girder Frame at transfer area in Moy / De- mobilise self-propelled trailer at site.

17. The transportation from Warrenpoint to Moy will take less than one day (Day 4 identified above) and

the transfer within Moy will take two days (Days 4 and 5 identified above).

7.3 Impacts of Transformer Transportation

7.3.1 Baseline

7.3.1.1 Overview

18. The route of the journey from Warrenpoint to the substation site north of Moy travels through the western sector of the town of Warrenpoint, the cities of Newry and Armagh and the village of Moy. The route is directly adjacent to and indirectly in the vicinity of residences, commercial and industrial businesses, public buildings, places of worship, schools and emergency services establishments.

19. Abnormal load road travel is an unusual activity, though when it occurs, it is most usually undertaken outside of peak traffic hours and on a Sunday (when possible) as this is regarded as one of the most inactive periods of road travel. Road travel does occur on a Sunday though the majority of national businesses are closed on Sundays as are schools and colleges.

7.3.1.2 Shopping

20. Many small retail outlets such as general newsagents, petrol stations and convenience stores may be open for trading throughout Sunday but larger retail outlets are restricted to specific opening hours. Sunday trading hours for shops in Northern Ireland are set out in the Shops (Sunday Trading &c.) (NI) Order 1997. Large shops (those with a floor area exceeding 280 square metres) are restricted to trading for a maximum of five hours between 1pm and 6pm on a Sunday.

21. There are numerous small retail outlets likely to be open that are adjacent to and close to the intended route along its length through Newry, Armagh and Moy.

22. There are two large shopping centres in the west of Newry which are accessed from the east via the proposed route through Newry City Centre. There is one large retail outlet on the northern outskirts of Newry which can be accessed via the route (A28).

23. There is one medium sized shopping centre in Armagh City Centre that is accessed from the route.

7.3.1.3 Religious Worship

24. Sunday mornings are regarded as the normal time of religious worship for the Christian communities of Counties Armagh and Down. Sunday Church services can take between 30 minutes and two hours, can begin as early as 6am and be undertaken at any time during the day. Church services are attended by all age groups who arrive at their place of worship normally on foot or by car.

25. All cities, towns and the majority of villages across Northern Ireland have established centres of worship (locations) such as churches and halls. There are no locations on or close to the route within Warrenpoint. There are eight locations on or close to the route through Newry city. There are six locations on or close to the route through Armagh city and three locations on or close to the intended route in Moy village.

7.3.1.4 Sport

26. The main sporting activities in Northern Ireland that may attract large numbers of spectators include Gaelic Athletic Association, soccer/football and rugby. Gaelic Athletic Association (GAA) football and hurling matches both at local level and County level are played on a Sunday and through the week. Football and rugby are played on an international, national and local level though these sports are not normally (but can be) played on a Sunday at international, national or local level. Local Authority

Sports pitches are available to a multiple of sports and Leisure Centres and swimming pools are open for private use and also local and regional competition events. These events do not normally attract numbers of spectators over two hundred.

27. There are no national or regional sports stadiums or centres along or close to the proposed route. There are two County GAA grounds close to and accessed via the route. Páirc Esler formerly Páirc an Iúir (also called The Marshes) is the County Down GAA ground and has a spectator capacity of 20,000. The County Armagh GAA ground is known as the Athletic Grounds (Páirc Lúthchleasaíochta) and has a capacity of 19,500.

28. There is one national football league stadium located close to and is accessed via the route. Newry City Football Club stadium is called the Showgrounds and has a capacity of just less than 8000.

29. There are no rugby stadia located on or close to the route.

30. There are local sports pitches/grounds adjacent and close to the route through the cities of Newry and Armagh.

7.3.1.5 Emergency Services

31. Emergency services locations and facilities (fire stations, hospitals and police stations) are located at strategic locations along the route:

- Warrenpoint fire station is located adjacent to the A2 (No.1 Meeting Street) east of the port exit point. Warrenpoint PSNI station is also located east of the port exit on Charlotte Street. It is a part time station and is attended: Tuesday 9am - 11am, Thursday 5pm - 7 pm and Saturday 12 noon - 2pm;
- Newry fire station is located on 6 Upper Edward Street, approximately 300m west of the proposed route;
- Daisyhill Hospital is the regional A&E centre and is located approximately 500m west of the proposed route;
- Newry Ardmore PSNI Station operates a 24hr service and is accessed directly from the route on Downshire Road (A28);
- Daisyhill Hospital is the regional A&E centre, is open 24 hrs and is located approximately 500m west of the proposed route through Newry city centre;
- Armagh PSNI Station is a 24 hr service, is located on the A28/A3 Junction in Armagh and is accessed directly from the route (A28);
- Armagh Community Hospital is located approximately 250 north of the proposed route through (the Mall) Armagh. It has a minor injuries unit and is open 5 days a week; from 9am to 5pm Monday to Friday, including Bank Holidays; and,
- Moy Health Centre provides primary care for Moy and the surrounding areas. Opening hours are 08.30 – 18.00 hrs Monday to Friday.

7.3.1.6 Public Transport

32. The proposed haulage route accesses current Translink and Bus Éireann public transport bus routes across its entire length.

7.3.1.7 Baseline Summary

33. Table 7.1 identifies those places along the route from Warrenpoint Port to Turleenan Substation (excluding residential buildings) and those distant from the route that the public /emergency services may wish to travel to or from and therefore potentially could be impacted by the transformer journey.

Table 7.1 Resources potentially impacted by Transformer Journey

Resource	Location	Issue
Mourne Mountains	Mourne Mountains	Access via A2 from west of Warrenpoint
Rostrevor Forest Park	Rostrevor Forest Park	Access via A2 from west of Warrenpoint
Warrenpoint Fire Station	1 Meeting Street	Emergency access to locations beyond the load
Warrenpoint PSNI Station	Charlotte Street	Emergency access to locations beyond the load
Showground Football Ground GAA Grounds	Ballinacraig Way, Newry, Down BT34 2QX	Access from the south east via A2 and from North west via Kilmorey Street
Convent Of Mercy Home Ave Newry BT34 2DL	Home Ave Newry BT34 2DL	Access from north west via Kilmorey Street and south east via A2
Brunscoil An Iuir Primary School	74 Kilmorey St, Newry, Down BT34 2DH	Access is on the route
Daisy Hill Hospital	5 Hospital Road Newry BT35 8DR	Access from south east (Kilmorey Street and Warrenpoint road. Access from north and east via Abbey Way, Upper Water Street, Trevor and A28. Access from A28
Newry Bus Station	Canal Quay Newry BT35 6BP	Access from south east (Kilmorey Street and Warrenpoint road. Access from north and east via Abbey Way, Upper Water Street, Trevor and A28. Access from A28
Newry Railway Station	Western outskirts of Newry	Access from all locations crossing or using route
First Presbyterian Church (Non-Subscribing), Newry	Junction of Kilmorey Street and William Street /Abbey Way	Access from the south east (Kilmorey Street and Warrenpoint road.
Newry Cathedral	Hill Street	(access from Abbey Way) Saturday Vigil: 6.00pm Sunday: 8.30am, 10.00am, 12noon (Children's Liturgy of the Word) and 5.30pm Weekday Mass: Monday - Saturday 8.30am and 10.30am
Riverside Reformed Presbyterian Church	Basin Walk Newry BT35 6HU	Access from north and south
Methodist Church	Sandys St Newry, BT34 1EN	Access from north (A28) and south (Trevor Hill)
Sandys Street Presbyterian Church	17 Windsor Hill Newry, Down BT34 1ER	Access from north (A28) and south (Trevor Hill)
Windsor Hill PS	Church Ave	Access from north (A28) and south (Trevor Hill)
Downshire Road Presbyterian Church	Downshire Rd Newry, Down BT34 1DX	Access from north and south (A28). No parking on street outside church.
Ardmore PSNI Station	65 Downshire Rd Newry BT34 1TH,	Access from A28

Resource	Location	Issue
Sports Pitches	Across the A28 from Ardmore PSNI Station	Access from A28
Newry High School	13-33 Ashgrove Rd Newry BT34,	Access from A28
Mourne Country Hotel Ambulance Outpost	South of Mourne Country Hotel Downshire Rd (A28)	Access from A28
Mourne Country Hotel	Downshire Rd (A28)	Access from A28
Jehovah Witness Kingdom Hall	Downshire Rd (A28)	Access from A28
B&Q DIY Centre	A28/Armagh Rd Roundabout	Access from A28
Armagh Leisure Centre	Off A28 in Armagh (150m north of route)	Access from A28 and A3 south
Athletic Grounds Armagh County GAA Board Grounds	Athletic Grounds	Access from A3 north and A28 southeast
Armagh Free Presbyterian Church	Georges St Armagh BT60 1BY	Access from A3 south and A28 Southeast
The Mall Armagh Shopping Centre	The Mall (A3)	Direct access to A3 (The Mall)
St Malachy's Chapel	Irish St Armagh BT61 7EP	Access from A3 North & A28 Southeast
St Patrick's Cathedral (Catholic)	Abbey Street, Armagh, BT61 7EE	Access from A3 North & A28 Southeast
St Patrick's Cathedral (Anglican)	Cathedral Close, Armagh, BT61 7EE	Access from A3 North & A28 Southeast
St. Marks Church	44 Victoria St Armagh BT61 9DT	Access from A3 south and A28 Southeast
Church of Ireland	46 Abbey St Armagh, County Armagh BT61 7DZ	Access from A3 North & A28 Southeast
Armagh Ulsterbus Station	1 Lonsdale Road Armagh	Direct access to and from A29 (Lonsdale Road).
Southern Regional College (Armagh Campus)	Lonsdale Building Armagh BT61 7HN	Direct access to and from A29 (Lonsdale Road).
Moy Health Centre	48 Charlemont St Dungannon, Moy County Tyrone BT71 7SL	Direct access onto A29 (Charlemont St)
St James Parish Church, Moy, Co Tyrone	The Square, Moy	Direct access onto A29 (Charlemont St)
Presbyterian Church in Ireland	Benburb Rd Moy	Access from north, south and east via A29
St John's Church	Benburb Rd Moy	Access from north, south and east via A29
A29 Road Closure	The Square Moy	Diversions to both traffic flows direction via Jockey Lane and The Square

7.3.2 Impact Assessment

7.3.2.1 Methodology

34. Table 7.2 provides definitions of the significance categories in which an impact arising from the Tyrone – Cavan Interconnector is categorised.

Table 7.2: Significance Categories

Significance category	Typical descriptors of effect
Very Large	Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.
Large	These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
Moderate	These beneficial or adverse effects may be important, but are not likely to be key decision-making factors.
Slight	These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

7.3.2.2 Assessment of Potential Impacts

35. As three transformers will be required, three trips from Warrenpoint to Moy will be required. The load will throughout the journey require both lanes on single carriageway roads and two lanes on dual carriageways. In Newry and Armagh cities, it will require travelling contraflow to the normal traffic direction at a number of manoeuvring restrictive locations and also make reversing manoeuvres at restrictive junctions. The maximum speed of the load is not expected to exceed 10 miles per hour. These conditions therefore indicate that there will be severe disruption to the road network of the proposed route, those roads accessing to and from the proposed route and the associated adjoining road network which may see additional traffic avoiding the proposed route.

36. The load will block the A2 from the Port exit to the Newry Burren roundabout in both directions. It will block the northwest bound dual carriageway of the A2 West from Newry/Burren roundabout to Greenbank roundabout in Newry. From this point onward to the completion of its journey, the load will block the complete roadway on which it travels.

37. The load will be driven and escorted by a specialist contractor for close manoeuvring communication and by the PSNI with a rolling road block throughout for traffic management. This road block would be further enforced during contraflow driving through Newry and for the reversing manoeuvre required in the centre of Armagh. This manoeuvre is necessary to mitigate a large amount of street furniture removal in the town, which would result in a high volume of disruption due to the amount of traffic lights and railings that would need to be removed. This manoeuvre would take approximately 20 minutes from the PSNI halting traffic to the trailer continuing on the correct side. The reverse manoeuvre in Armagh would also take approximately 20 minutes and would allow for a smaller amount of street furniture to be removed. The travel time from Warrenpoint to the transfer area in Moy would take five to seven hours including all manoeuvres. Following the transfer to self-propelled trailer, travel time from Moy to site would take approximately one hour. The day on which the transport will take place will be dictated by the authorities on permit application. Abnormal moves predominantly take place on a Sunday and following an overnight stop at the transfer area on the A29 carriageway in Moy, the transfer and subsequent self-propelled trailer move to the site would take place on the Monday. The journey to site is expected to take one hour.

38. The impacts expected to be encountered from the operation will relate to the use of the route to be taken by the abnormal load and the associated adjoining road network and will affect mainly road users. Road users travelling east on, accessing to and from the A2 between the Newry /Burren

roundabout to Warrenpoint Port exit will be halted until the abnormal load passes west of the roundabout.

39. Traffic wishing to access the A2 road in the vicinity of the load, will be prevented from doing so by the PSNI rolling block at junctions. From Warrenpoint Port exit traffic travelling behind the load will be prevented from passing the load due to the load width taking up the complete roadway.

40. After Greenbank roundabout (the end of the Warrenpoint Road (A2) dual carriageway, Newry) from the Warrenpoint Road single carriageway, to the end of the journey, the load will block all roads on which it travels preventing other vehicle travel in either direction. The roads directly blocked in Newry City and onward will be Warrenpoint Road, Kilmorey Road, Abbey Way, Upper Water Street, Trevor Hill, a short section of the A27, the A28 Downshire Road, and the A28 through to the Armagh Road roundabout north west of Newry city. From this point the A28 turns towards Armagh and the rolling roadblock will prevent vehicle travel again in both directions.

41. Upon reaching the A28 /A3 junction in Armagh city, the required reversing manoeuvre will necessitate blocking the following roads, the A28, the A3 Friary Road, Scotch Street, A3 Gaol Square, and A3 the Mall. The load will exit Armagh City via the A29 northwards which shall be blocked in both directions again with a rolling PSNI roadblock until the load stops for transfer to the self-propelled trailer in the location of The Diamond in the village of Moy. The A29 will be blocked in both directions at this point and traffic directed around the load via Jockey Lane south of the A29 and The Square north of the A29. The diversions may be in place in excess of 24 hrs. Parking restrictions may be required to allow for the diversions.

42. After transfer, the load will negotiate the A29/B106 Junction and travel along the B106 (Killyman Street). The street will require 300m of parking restrictions to allow access for the load. The PSNI rolling road block will continue to escort the load for the 3km journey to the destination at the proposed Turleenan substation.

43. A general assumption can be made that road traffic numbers will increase behind the load until vehicles are able to manoeuvre around the load either directly on the route or via adjoining roads on the network. A further assumption is made that the high majority of vehicles travelling on a Sunday along the proposed route will be cars with very small numbers of HGVs.

44. The potential social impacts of the transformer transport are:

- Traffic noise and vibration
- Disruption and driver delay
- Increased risk of accidents
- Pedestrian Severance, Intimidation and Delay
- Visual effects
- Loss of retail trade

45. **Traffic noise and vibration –** traffic affected by the load and the load itself will be travelling slowly generating low noise and low levels of vibration. The potential traffic noise impact on local residential receptors in the vicinity of the route would be **temporary moderate adverse** impacts.

46. **Disruption and driver delay –** the effects of delay to other local road users across the route and potentially on diversionary routes taken by drivers will be apparent during the movement of the abnormal load as a result of the large size and low speed. Whilst the load is on the A2 Warrenpoint dual carriage way, delays will have less of an impact on southeast bound road users. From the Greenbank roundabout northwest through to the end of the journey traffic travelling on and accessing the route will be faced with a rolling blockade. The potential traffic disruption and driver delay impact on road users on and in the vicinity of the route would be temporary in nature and will vary depending on the destination of the road user and their perceived importance in reaching their destination at a specific time. Larger impacts are likely to be felt in Newry and Armagh should the load journey coincide with public travel to and from those places of worship in close proximity to the journey route. The greatest effects are likely to be felt by those road users wishing to travel on the A29 between Moy and Armagh. The A29 temporary road closure at the Diamond in Moy is likely to cause significant

disruption to the local and regional road network should temporary diversions be allowed via Jockey Lane and The Square. Potentially additional distant (to Moy) diversions may be required to reduce Safety Risks at Moy. The road network around Moy though is through large rural areas both to the east and the west. The road network consists of mainly B roads and diversions may bring additional impacts to those people living and working in these areas. Strategic diversions may have to be considered on the A29 beginning as far south as the A29/A3 interface in Armagh and as far north as the M1 Junction 15. All diversions are likely to increase travel times, cause disruption to the network and driver delay impacts for a short term though at a large scale. The impacts are likely to be **temporary moderate adverse**.

47. **Increased risk of accidents –** any increase in traffic numbers has the theoretical potential to increase the risk of accidents. The load will be travelling slowly and affected traffic will also be travelling slowly behind it. However, there is a potential for impacts on safety as a consequence of driver frustration related to the movement of the abnormal load from when vehicles are free from the restrictions and may feel the requirement to speed to make up for lost time. The increased risk of accidents would be temporary in nature and would range from small to large dependant on levels of individual driver frustration. The impacts are likely to be **temporary slight adverse**.

48. **Pedestrian Severance, Intimidation and Delay –** an increase in vehicle numbers behind the load, through Warrenpoint, Newry, Armagh and Moy, could result in additional delays to pedestrians wishing to cross i.e. severance. High volume traffic can reduce the amenity of pedestrian routes in cities, towns and villages to the extent that pedestrians feel intimidated by the traffic. Due to the slow speed of the delayed traffic behind the load and the number of available routes avoiding the load in Warrenpoint, Newry, Armagh there is expected to be negligible effect on severance, intimidation and pedestrian delay on these routes, except possibly where the route reaches Moy adjacent to the Diamond which due to the proposed transfer of the load and temporarily blocking of the A29 for an extended period, the effect on severance, intimidation and pedestrian delay could be on a large scale. The impacts are likely to be **temporary moderate adverse**.

49. **Visual effects –** the movements of high-sided vehicles could be considered visually intrusive. This effect would be short-term, localised and of a small scale. The impacts are likely to be **temporary moderate adverse**.

50. **Loss of retail trade –** The disruption to the road network and driver delay could present impacts within the local retail industry. Many retail outlets, small and large are strategically located on the road network to serve their customer base. The journey of the load on the road network has the potential to prevent road users accessing the road network during retail trading hours. Parking restrictions imposed by authorities may impede parking of vehicles on the roadway close to retail outlets before and during the load movement. There is potential for the load movement operation to therefore reduce customer numbers reaching retail outlets and affect sales. The impact of the journey in regard to loss of retail trade is expected to be short-term and minor. The movement of the load will cause short-term delay to road users using the local road network. The route has many side roads available to vehicles to use to park on if parking restrictions are located outside or close to retail outlets. Larger outlets generally have their own off-road parking facilities. The impacts are likely to be **temporary slight adverse**.

7.3.3 Mitigation

51. The movement of the transformer from Warrenpoint Port to Turleenan substation north of Moy will have a detailed Traffic Management Plan developed and approved by the appropriate authorities and consider the views of stakeholders such as Local Councils and the PSNI. The implementation of the traffic management plan and staging strategy will aim to reduce the impacts to road users, pedestrians, residents and retail outlets on the route and across the local and regional road network.

52. The traffic management plan will include the following:

- Plan the movement of the abnormal load for a Sunday when the road network is typically at its quietest;
- Appropriate Police or contractor escort to accompany movement of the abnormal load to be

agreed with the local authorities and police where appropriate;

- Identification and advanced notification to key stakeholders(those who may be greatly impacted by the load movement);
- Advanced notification to the general public warning of the abnormal load transport movement;
- Informative road signage warning other users of traffic movements;
- Specific timing of the movement outside of peak traffic hours and avoiding specific events that may be impacted adversely;
- Identification of locations on the route where the load may be stopped or directed to one side of the carriageway to allow traffic to pass;
- Identification of diversionary routes for road users with approximate timings to specific (key) destinations;
- Specific diversions for A29 north and south bound traffic avoiding the village of Moy where the A29 will be temporarily blocked for potentially 24 hrs; and,
- Provision of temporary signs and traffic control where necessary.

53. SONI and the appointed load movement contractor will consider, in addition to the above mitigation measures, the appropriate use of social media to inform the public of the planned traffic movements and road network restrictions before and during the movement. The use of social media would allow the promulgation of information beyond the local environs to the journey route and allow the public to make informed journey decisions remote from the route where individual situations and conditions allow.

7.3.4 Residual Impact

54. The implementation of the mitigation measures described above, and the short-term (between a few minutes and one hour) and generally localised nature of the effects to the majority of road users, pedestrians and residences along the route of the movement, would result in minimal residual impacts from the transportation of the transformers in regard to noise and vibration, visual amenity and loss of retail trade. Though the implementation of the proposed Traffic Management Plan would intend to inform all road users at an appropriate time before the load movement, there will likely be road users who have not been informed (i.e. casual visitors to the road network area) that may be affected by the load journey. Therefore in regard to disruption and driver delay; increased risk of accidents and severance, and pedestrian delay there is potential for localised, **short-term moderate adverse** impacts on road users.

7.4 Conclusions

55. A 20-axle transporter will be required to slowly transport the three approximately 222t transformers from Warrenpoint port to Moy. This transportation will require three trips (up to seven hours per trip) and will result in traffic disruption because of temporary road closures and the slow moving traffic.

56. Because of a sharp turn in Moy village, it will be necessary to transfer the transformers by crane from the 20-axle transporter to a smaller self-propelled trailer. This will result in the closure of the B106 in the centre of Moy square and diversion system will be in operation at the northern and southern end of the square. This will result in disruption to the traffic, visual and noise impacts and will disrupt the normal use of Moy village. This transfer will require two days per trip; six days in total. The three required trips will be spaced apart to minimise disruption.

Mitigation measures and publicity of the transport will inform and help to minimise the disruption. The mitigation measures will include police escorts, appropriate signage of alternative routes and diversions, and undertaking works in daylight only. There is potential for localised, **short-term moderate adverse** impacts to road users with no long-term impacts on the completion of the transport.

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Chapter 8
Ecology



Main Text Volume 2

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SONI
Tyrone Cavan
Interconnector

The current. The future.

8 Ecology

8.1 Information to Inform Habitats Regulations Assessment

1. The first stage of the Habitats Regulations Assessment (HRA) (Stage 1 Screening Stage) was submitted as a draft report with the Consolidated ES (May 2013). The screening stage assessed that there would be no likely significant effect on any European sites in view of their conservation objectives arising from the Tyrone - Cavan Interconnector.

2. A review of the draft/shadow Stage 1 Habitats Regulations Assessment screening report (appendix 10H Consolidated ES) was undertaken as part of the preparation of the Consolidated ES Addendum. This review identified the need to update the information required to inform the Habitats Regulations Assessment for the following reasons:

    - The draft/shadow Stage 1 Habitats Regulations Assessment was prepared at a time when information on the design of the associated Proposed Development in RoI was not complete
    - The incorporated mitigation has been modified to include additional bird diverters between Towers 1 and 13; and,
    - The inclusion of more remote SPA sites (greater than 30km) for which whooper swan is a qualifying interest species to allow for screening of potential interactions during migratory periods (Autumn and Spring) as birds move between staging sites and onward journeys to wintering and breeding grounds (spring).

3. The revised report upholds the conclusions of no likely significant effects on the conservation objectives of any European Site in the construction or operational phase of the proposed Tyrone Cavan Interconnector. Additional information is presented that will allow the Competent Authority to undertake a Habitats Regulations Assessment.

4. Appendix 8.1 of this report presents Information to Inform HRA for the Tyrone – Cavan Interconnector. It has been determined that there will be no likely significant effects and thus no adverse effects to any European or Ramsar sites arising from the Tyrone – Cavan Interconnector and is thus compliant with PPS 2 policy NH 1.

8.2 2013 Ecology Surveys

8.2.1 Overview

5. The Consolidated ES was published in May 2013 and contained an ecological assessment chapter (Chapter 10) for the Tyrone - Cavan Interconnector. The Consolidated ES was based on surveys undertaken in 2012 and from previous years as appropriate. The Consolidated ES has now been supplemented with the results of 2013 ecology surveys. In 2013 the following surveys were undertaken:

    - Smooth newt surveys;
    - Bat activity walked transects were undertaken between May and July 2013 for approximately 76% of the Tyrone - Cavan Interconnector; and,
    - Emergence and re-entry surveys were conducted on trees and buildings with potential to support roosting bats between May and July 2013.

6. The 2013 results and assessments are summarised below and the details are presented in the appendices of this report (Appendices 8.2 and 8.3). It has been determined the assessment as presented in the Consolidated ES remains valid. The 2013 surveys have added to the robustness of the assessment and the overall findings have not changed.

8.2.2 Smooth Newt Surveys (2013)

7. A full report for the smooth newt surveys (2013) has been prepared and is contained in Appendix 8.2 of this report.

8. Eight sites previously identified as having potential to support smooth newts were assessed in 2013. Each was subjected to a modified Habitat Suitability Index (HSI[74]) assessment to identify the potential for each to support the aquatic life stages of smooth newts. The results of this HSI assessment are shown in Appendix 8.2. The maps showing the locations of the surveyed ponds are also included at Appendix 8.2 (Figures A-F).

9. Following on from this HSI, a field survey consisting of four separate surveys was undertaken between early May and early June 2013 (See Appendix 8.2 for full details) of Site 3.

10. Site 3 is located 160m east of tower 13 and is oversailed in part by the overhead line. It contains a wide drain, approximately 2 metres in width, and up to 1 metre deep. Aquatic vegetation is abundant and there is a large tract of woodland adjacent to the drain and frog tadpoles present. Other invertebrates identified included water snails and great diving beetles. Small fish were observed in deepest parts, likely to be stickleback. In all it is an area of potentially suitable habitat over 500 square metres, including terrestrial areas.

11. No smooth newts, or evidence of smooth newts, were found during this suite of survey work.

12. The proposed overhead line will approach wet areas that have the potential to support smooth newt populations. Lines will oversail these areas, and there will be no physical impacts on the wetland from the stringing works (i.e. no overhead lines on the ground during the operation). Habitats surrounding the wetlands are dominated by improved grassland, which is likely to be unattractive to dispersing newts, and the location of towers in these circumstances will have no impact on the species. Surveys over a number of seasons have shown that smooth newts are likely absent from the route. The magnitude of impact on smooth newts will be negligible.

8.2.3 Bat Surveys (2013)

13. In summer 2013, walked transect dusk surveys and emergence and re-entry surveys of trees and buildings were carried out. These were carried out in order to allow a comparison of activity levels between survey years, ensure that contemporary data are available for assessment and to identify use of high potential trees and buildings identified in previous survey years for roosting bat presence or likely absence.

[74] In lieu of local species specific guidance, the assessment was based on guidance outlined in the Joint Nature Conservation Committees' published Herpetofauna Workers' Manual (Joint Nature Conservation Committee, 2003) and the Great Crested Newt Conservation Handbook (Langton, Beckett & Foster, 2001). For great crested newts, Natural England recommends the Oldham et al. (2000) Habitat Suitability Index (HSI) to assess waterbodies on site, for their suitability to host smooth newts. It is accepted that habitat requirements for smooth newt and great crested newt are synonymous and therefore whilst the HSI is intended for a different species, it is broadly applicable to the smooth newt.

Walked Transect Surveys (2013)

14. During the 2013 surveys each walked transect was undertaken by a surveyor(s) walking at a constant speed along a pre-determined route with regular listening points, using a heterodyne or time expansion bat detector with recording function so that all bat numbers and bat passes were recorded for subsequent analysis. The listening points were placed along the route of the Tyrone - Cavan Interconnector where it crosses a linear feature or in locations where the route of the Tyrone - Cavan Interconnector runs adjacent to a linear feature. During the surveys each surveyor recorded the number of bats and bat passes for subsequent analysis. Bat activity was recorded for at least 3 minutes at each listening point, as well as continuously between each of the points (refer to Appendix 8.3 for the transect locations). The data collected were used to provide an index of bat activity along each transect. Surveys commenced at 15 to 30 minutes before sunset (to allow for the differing emergence times of bat species) and continued for at least 2 hours after sunset. Surveys were carried out during suitable weather conditions.

15. Data collected from the transect surveys were analysed to species level where possible using BatSound and Analook sound analysis software.

16. The surveyed area included the footprint of the proposed substation and 102 proposed tower locations. The proposed substation location was surveyed twice in 2013 and the opportunity was taken to rotate the survey direction.

17. Out of the 102 proposed tower locations, 65 were surveyed in 2013 (where the surveyor had access to the field in which the proposed tower was located); the remaining 37 proposed tower locations could not be surveyed as land access was not permitted. Of the 65 proposed tower locations surveyed, over half (47) were surveyed twice and on 11 of these occasions the opportunity was taken to rotate the survey direction to reduce the potential bias related to the timing of the survey. The remainder of the proposed tower locations (18) were surveyed only once during 2013, which did not present the opportunity to rotate the survey direction and limit this potential bias. It should be noted that, of the remainder of the proposed tower locations only surveyed once in 2013, 24 had previously been surveyed in 2012.

Emergence and Re-Entry Surveys for Trees and Buildings (2013)

18. Emergence and re-entry surveys were carried out following the results of a tree and buildings assessment for bats carried out in April and May 2013.

19. Three emergence surveys were carried out in May 2013. One emergence survey was carried out on 26th May 2013 at an alder tree within the substation area, and one at the tin roofed barn within the substation area. One emergence survey was carried out on 27th May 2013 at the ash tree to the east of the proposed Tower 60.

20. The surveys commenced 15 to 30 minutes prior to sunset and continued for at least 2 hours after sunset. Any bats exiting the trees/structure were recorded as were the number of bats and passes heard/seen during the survey. The locations of the trees/structures surveyed are shown in Appendix 8.3 of this report.

21. Re-entry surveys were carried out in May, June and July 2013.

22. On 24th May 2013 a re-entry survey of the alder tree located in the north-eastern area of the substation area was carried out, and on 28th May 2013 a re-entry survey was carried out at the tin roofed barn within the substation area. On 25th June 2013 a re-entry survey of the alder and a re-entry survey of the tin roofed barn were carried out. On 27th June 2013 and 19th July 2013 re-entry surveys were carried out at the ash tree to the east of proposed Tower 60.

23. The re-entry surveys commenced two hours before sunrise and were completed at sunrise or up to 30mins after sunrise. The number of bats and passes and swarming behaviour were recorded and any bats entering the trees/structure were also recorded.

24. In accordance with Bat Conservation Trust guidance the weather conditions for each survey were recorded and were considered favourable for bats. Surveys were not undertaken when conditions were considered unfavourable. Weather conditions for each survey are provided in Appendix 8.3 of this

report.

25. The identified single tin roofed barn within the substation site has been shown to be used occasionally by roosting bats (one Leisler's bat in 2009 and one common pipistrelle bat in 2013). Results from field activity surveys show that bats use the general area of the substation site for foraging; however the removal of vegetation at the substation site will not remove a significant foraging habitat. Replacement roosting opportunities will be provided (under a European Protected Species Licence) to enhance the site for bats in the form of four roosting boxes fixed at suitable locations (to be agreed after construction with a suitably qualified and experienced ecologist) on the outside of the substation buildings or security fence.

26. Two trees (the alder at the substation site and the ash at Tower 60) within the Tyrone - Cavan Interconnector have been shown to be used by single roosting bats on an occasional basis (based on the surveys undertaken in 2008 and 2013). Both trees will be lost during the enabling works phase of the construction period.

27. During the 2013 bat surveys, three features (two trees and one building) have been proven to support occasional roosting by a small number of bats and these will need to be removed under licence prior to enabling works. Site-specific mitigation will include measures to ensure roost replacement. The Tyrone - Cavan Interconnector route has few opportunities for roosting bats at present and the planned enhancement measure of placing 100 bat boxes of various types along the route will provide significantly more opportunities for roosting bats in the future.

28. The Tyrone - Cavan Interconnector may disturb small numbers of foraging bats temporarily during the construction period and will displace three known transitional roost sites. Mitigation measures pre, during and post construction will ensure that there is no adverse impact upon the conservation status of any bat species locally and will ultimately provide significantly greater roosting opportunities than at present, which may lead to an increase in the number of bats using the area.

Overall Summary of Impacts to Bats

29. All of the surveys undertaken along the Tyrone - Cavan Interconnector route (between 2008 and 2013) have confirmed usage by bats. Bats have been identified throughout the study area and have been encountered roosting (albeit in small numbers), commuting and foraging. However, due to the types of impacts expected (primarily, short sections of hedge removal and to a lesser extent mature tree removal to create breeches, and a building roost removal) the significance of impact on the bat population is considered to be minor negative without mitigation.

30. Survey work was conducted for bats between 2009 and 2013 within and outside the footprint of the Tyrone - Cavan Interconnector. A range of survey methodologies were used to assess the value of the area of the Tyrone - Cavan Interconnector to foraging, commuting and roosting bats. The extended survey period over a number of years has illustrated that the area of Tyrone - Cavan Interconnector supports a diverse range of species (in a Northern Ireland context) in relatively small numbers. Occasional hotspots of foraging have been identified and these are likely to change depending upon wind direction and local, current land use. Overall the pattern of activity is typical of the habitat types and region. Primarily arable and pasture land with a lack of mature trees and buildings do not provide significant opportunities for bats and this probably reflects the relatively low levels of activity along much of the route. Three features (two trees and one building) have been proven to support occasional roosting by a small number of bats and these will need to be removed under licence prior to enabling works, which will include site-specific mitigation measures to ensure roost replacement. The route of the Tyrone - Cavan Interconnector has few opportunities for roosting bats at present and the planned enhancement measure of placing 100 bat boxes of various types along the route of the Tyrone - Cavan Interconnector will provide significantly more opportunities for roosting bats in the future.

    The Tyrone - Cavan Interconnector may disturb small numbers of foraging bats temporarily during the construction period and will displace three known transitional roosts sites. Mitigation measures pre, during and post construction (as outlined in Chapter 10 (Ecology) of the Consolidated ES) will ensure that there is no adverse impact upon the conservation status of any bat species locally and will ultimately provide significantly greater roosting opportunities than at present which may lead to an increase in the number of bats using the area.

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Chapter 9 Air and Climate Change



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9 Air and Climate Change

9.1 Introduction

1. This Section of the Consolidated ES Addendum provides an assessment of the impacts of the Tyrone - Cavan Interconnector on local air quality and climate change effects during construction and operation.

2. The Section describes the assessment methodology; the baseline conditions; the likely significant environmental effects; the mitigation measures required to prevent, reduce or offset adverse effects; and the likely residual effects after these measures have been employed.

9.2 Assessment Methodology

9.2.1 Construction Phase Air Quality Effects

9.2.1.1 Overview

3. The potential for air quality impacts has been assessed for the construction phase, during which the greatest impact is expected to be from dust near the construction sites and with associated works. It has been determined that the operational phase of the Tyrone - Cavan Interconnector will have no likely significant air quality impacts and has been scoped out of this assessment.

4. The impacts associated with the construction phase of the Tyrone - Cavan Interconnector have been qualitatively assessed with reference to the Institute of Air Quality Management (IAQM) published 'Guidance on the Assessment of Dust from Demolition and Construction' (IAQM, 2014). According to the IAQM, the main air quality impacts that may arise during construction activities are:

    - Dust deposition, resulting in the soiling of surfaces;
    - Visible dust plumes, which are evidence of dust emissions;
    - Elevated PM_{10} concentrations, as a result of dust generating activities on site; and
    - An increase in concentration of airborne particles and nitrogen dioxide due to exhaust emissions from diesel powered vehicles and equipment on site and vehicles accessing the site.

5. Activities on construction sites are classified into four types to reflect their different potential impacts:

    - Demolition;
    - Earthworks;
    - Construction; and
    - Track-out (the transportation of dust and dirt from the construction site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network).

6. The following steps, as defined by the IAQM, were followed to determine the risk of impacts, appropriate mitigation measures to be adopted, and significance of residual impacts.

9.2.1.2 Step 1: Screen the requirement for a detailed assessment.

7. Sensitive receptors and the distance to the proposed route were determined. According to the IAQM, an assessment will normally be required where there are sensitive receptors within 350m of the boundary of a site and/or within 50m of route(s) used by construction vehicles on the public highway, or up to 500m from the site entrance. A human receptor, as considered within the IAQM guidance, is any location where a person or dwelling may experience:

- The annoyance effects of airborne dust or dust soiling e.g. dwellings, industrial or commercial premises such as a vehicle showroom, food manufacturers, electronics manufacturers, amenity areas and horticultural operations; or
- Exposure to PM_{10} over a period relevant to the air quality objectives.

8. An ecological receptor refers to any sensitive habitat affected by dust soiling and includes locations with a statutory national or international designation e.g. Areas of Special Scientific Interest (ASSI) and Special Areas of Conservation (SAC). Ecological receptors may be affected if they are within 50m of the boundary of the site or routes used by construction vehicles on the public highway, or up to 500m from site entrances.

Table 9.1: Examples of Dust Sensitive Receptors

Sensitivity	Dust Soiling	Human Health	Ecological
High	- dwellings, - museum and other culturally important collections, - medium and long term car parks, - car showrooms.	- residential dwellings, - hospitals, - schools, - residential care homes	- locations with an international or national designation (e.g. SAC) and the designated features may be affected by dust soiling.
Medium	- parks, - places of work.	- office and shop workers, but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation.	- locations with a national designation (e.g. ASSI) where the features may be affected by dust deposition.
Low	- playing fields, - farmland (unless commercially-sensitive horticultural), - footpaths, - short term car parks, - roads	- public footpaths, - playing fields, - parks, - shopping streets.	- locations with a local designation where the features may be affected by dust deposition (e.g. local Nature Reserve with dust sensitive features).

9.2.1.3 Step 2: Assess the risk of dust effects

9. The risk of dust arising in sufficient quantities to cause annoyance and/or health or ecological effects was determined for each activity, taking account of:

- the scale and nature of the works, which determines the potential dust emission magnitude (small, medium or large) (Step 2A); and
- the sensitivity of the area (low, medium or high) (Step 2B).

10. These factors were then combined to give the risk of dust impacts with no mitigation applied, as Negligible, Low, Medium or High.

11. It should be noted that where detailed information was not available to inform the risk category,

professional judgment and experience was used and a precautionary approach adopted, in accordance with the guidance.

9.2.1.4 Step 2A – Define the potential Dust Emission Magnitude

Demolition

12. The classifications in Table 9.2 are based on examples of suitable criteria, although factors such as seasonality, building type, duration and scale were also taken into consideration.

Table 9.2: Potential Demolition Dust Emission Classification

Potential Dust Emission Classes	Criteria
Large	Total Building Area: > 50,000 m^3 Potentially dusty construction material (e.g. concrete) On-site crushing and screening Demolition activities: > 20 m above ground level
Medium	Total Building Area: 20,000 - 50,000 m^3 Potentially dusty construction material Demolition activities: 10 - 20 m above ground level
Small	Total Building Area: < 20,000 m^3 construction material with low potential for dust release Demolition activities: < 10 m above ground level, Demolition occurring in wetter months

Earthworks

13. Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. The classifications in Table 9.3 are based on examples of suitable criteria. Factors such as existing land use, seasonality, duration and scale were also taken into consideration.

Table 9.3: Potential Earthworks Dust Emission Classification

Potential Dust Emission Classes	Criteria
Large	Total site area: >10,000 m^2 Potentially dusty soil type (e.g. clay) >10 heavy earth moving vehicle active at any one time Formation of bunds >8 m in height Total material moved >100,000 tonnes
Medium	Total site area: 2,500 - 10,000 m^2 Moderately dusty soil type (e.g. silt) 5 -10 heavy earth moving vehicle active at any one time Formation of bunds 4 - 8 m in height Total material moved 20,000 – 100,000 tonnes
Small	Total site area: <2,500 m^2 Soil type with large grain size (e.g. sand) < 5 heavy earth moving vehicle active at any one time Formation of bunds < 4 m in height Total material moved <20,000 tonnes Earthworks during wetter months

Construction

14. The key issues when determining the potential dust emission magnitude during the construction phase include the size of the building(s)/infrastructure, method of construction, construction materials and duration of build. The classifications in Table 9.4 are based on examples of suitable criteria. Factors such as seasonality, building type, duration and scale were also taken into consideration.

Table 9.4: Potential Construction Dust Emission Classification

Potential Dust Emission Classes	Criteria
Large	Total building/structure demolition volume >100,000m^3 Piling, on site concrete batching, sandblasting
Medium	Total building/structure demolition volume 25,000 – 100,000m^3 Potentially dusty construction material (e.g. concrete) On-site concrete batching
Small	Total building/structure demolition volume <25,000m^3 Construction material with low potential for dust release (e.g. metal cladding or timber)

Track-out

15. Track-out is the transport of dust and dirt from the construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the local road network. The classifications in Table 9.5 are based on examples of suitable criteria. Factors such as vehicle size, speed, numbers, geology and duration were also taken into consideration

Table 9.5: Potential Track-out Dust Emission Classification

Potential Dust Emission Classes	Criteria
Large	50 HDV (>3.5t) outward movements in any one day Potentially dusty surface material Unpaved road length > 100 m
Medium	25 – 100 HDV (>3.5t) outward movements in any one day Moderately dusty surface material Unpaved road length 50 – 100 m
Small / Medium	< 25 HDV (>3.5t) outward movements in any one day Surface material with low potential for dust release Unpaved road length < 50m

9.2.1.5 Step 2B – Define the Sensitivity of the Area

16. The sensitivity of the area takes account of the following factors:

- The specific sensitivities of receptors in the area;
- The proximity and number of those receptors;
- In the case of PM_{10}, the local background concentrations; and
- Site-specific factors, such as whether there are natural shelters, such as trees to reduce the risk of wind-blown dust.

17. The sensitivity of the area is determined separately for dust soiling effects on people and dwellings (Table 9.6), human health effects (Table 9.7).and ecological impacts (Table 9.8).

Table 9.6: Sensitivity of the Area to Dust Soiling Effects on People and Dwelling

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		< 20	< 50	< 100	< 350
High	>100	High	High	Medium	Low
	10 – 100	High	Medium	Low	Low
	1 -10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 9.7: Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from the Source (m)				
			20	50	100	200	500
High	>32 µg/m^3	>100	High	High	High	Medium	Low
		10 – 100	High	High	Medium	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	28 – 32 µg/ m^3	>100	High	High	Medium	Low	Low
		10 – 100	High	Medium	Low	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	24 – 28 µg/ m^3	>100	High	Medium	Low	Low	Low
		10 – 100	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	<24 µg/ m^3	>100	Medium	Low	Low	Low	Low
		10 – 100	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table 9.8: Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from the Source	
	< 20 m	< 50 m
High	High	Medium
Medium	Medium	Low
Low	Low	Low

9.2.1.6 Step 2C - Define the Risk of Impacts

18. The dust emission magnitude determined at Step 2A should be combined with the sensitivity of the area determined at Step 2B to determine the risk of impacts with no mitigation applied. This Step is undertaken for each activity undertaken on site according to the matrices in Tables 9.9 to 9.12.

Table 9.9: Risk of Dust Impacts – Demolition

Sensitivity of Area	Dust Emission Classification		
	Large	Medium	Small
High	High	Medium	Medium
Medium	High	Medium	Low
Low	Medium	Low	Negligible

Table 9.10: Risk of Dust Impacts – Earthworks

Sensitivity of Area	Dust Emission Classification		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

Table 9.11: Risk of Dust Impacts – Construction

Sensitivity of Area	Dust Emission Classification		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

Table 9.12: Risk of Dust Impacts – Track out

Sensitivity of Area	Dust Emission Classification		
	Large	Medium	Small
High	High	Medium	Medium
Medium	Medium	Low	Negligible
Low	Low	Low	Negligible

9.2.1.7 Step 3: Identify the need for site-specific mitigation

19. Based on the risk of effects determined in Step 2C, appropriate general mitigation measures for each stage of the works were recommended, based on measures advised in the IAQM Guidance (2014), as highlighted in Section 9.5 of this chapter.

9.2.1.8 Step 4: Define effects and their significance

20. Finally the significance of the potential residual dust effects, i.e. after mitigation, was determined. According to the IAQM Guidance (2014) the residual impacts assume that all mitigation measures (recommended in Step 3) to avoid or reduce effects are adhered to, and therefore the residual impacts should be considered 'not significant'.

9.2.1.9 Construction Traffic Assessment

21. The following criteria are considered to be a robust determination of the need for an air quality assessment. An air quality assessment may be required if:

- Road alignment will change by 5m or more;
- Daily traffic flows will change by 1000 AADT or more;
- Heavy Duty Vehicles (HDV) flows will change by 200 AADT or more;
- Daily average speed will change by 10km/hr or more; or
- Peak hour speed will change by 20km/hr or more.

22. Furthermore, according to the EPUK Guidance (EPUK, 2010) criteria, a quantitative construction phase assessment of potential emissions from vehicles should only be undertaken for, 'large, long term construction sites that would generate large Heavy Goods Vehicle (HGV) (>3.5 tonnes) flows (>200 movements per day) over a period of a year or more'.

23. The nature of the Tyrone - Cavan Interconnector means that there will be no changes in road alignments, no changes in Annual Average Daily Traffic flows of more than 1,000 or HGV changes of 200 (the maximum is 48) and there will be no change to the daily average or peak hour speeds.

9.2.2 Air Quality Operational Phase Effects

24. There will be no emissions from the towers or overhead line and any associated maintenance traffic will be very low – one vehicle trip to the tower locations every two years, and vehicles associated with the vegetation clearance 5-year cycle. At the proposed substation, a maximum of two vehicles per day is anticipated during operation and three or four per day during maintenance, which will normally take no longer than one week each year (see Chapter 5 Proposed Development and Chapter 18 Transport of the Consolidated ES for further details).

9.2.3 Climate Change Effects

25. The likely climate change effects of the construction and operation of the of the Tyrone - Cavan Interconnector are assessed in this chapter. These effects have been discussed qualitatively below with reference to the UK and Northern Ireland climate change commitments.

26. During its operation, the proposed substation will use sulphur hexafluoride (SF6) gas in sealed circuits as a gas insulator. The gas will be sealed and therefore there will be no emissions to the atmosphere. NIE will operate the proposed substation and has in place a policy which provides guidance on the recording, handling, storage, recovery, monitoring and disposal of SF6 gas in accordance with the F-gas regulations (Main Regulation: (EC) No 842/2006 of 17th May 2006). SF6 gas is a greenhouse gas. However, its use will not cause any quantities of greenhouse gas to be emitted and so it has been scoped out of the assessment.

9.2.4 Legislative and Policy Context

9.2.4.1 Overview

27. The provisions of Part III of the Environment (Northern Ireland) Order 2002 establish a national framework for air quality management, which requires all local authorities in Northern Ireland to conduct local air quality reviews. Article 11 of the Order requires these reviews to include an assessment of the current air quality in the area and the predicted air quality in future years. Should the reviews indicate that the standards prescribed in the Air Quality Strategy (AQS) and the Air Quality Standards Regulations (Northern Ireland) 2010 ('Air Quality Standards Regulations') (S.R. 2010 No. 188) will not be met, the local authority is required to designate an Air Quality Management Area (AQMA). An Action Plan must then be prepared to try to improve air quality. This process is known as 'local air quality management (LAQM)'.

28. The Air Quality Standards Regulations revoked the Air Quality Standards Regulations (Northern Ireland) 2007 (S.R. 2007 No. 265), which had in turn replaced the Air Quality Limit Values Regulations (Northern Ireland) 2002 (S.R. 2002 No. 94 as amended by S.R. 2002 No. 357, and S.R. 2004 No. 514 and S.R. 2007 No. 265) and the Air Quality Limit Values (Amendment) Regulations (Northern Ireland) 2002 (S.R. 2002 No. 357) and the Air Quality Regulations (Northern Ireland) 2003 (as amended). These Regulations apply to Northern Ireland only. They place responsibility on the Department of the Environment (DoE) to designate zones in which ambient air will be protected by limiting the concentration of pollutants within them. In doing so, they replace and revoke the Air Quality Standards Regulations (Northern Ireland) 2007 and implement European Council Directive 2008/50/EC (refer to following section of this chapter). They also work in combination with a number of UK-wide provisions in the English Air Quality Standards Regulations 2010.

29. The UK Government and the devolved administrations published the latest AQS for England, Scotland, Wales and Northern Ireland on 17 July 2007, (The Stationary Office, (TSO), 2007). The AQS identifies ten ambient air pollutants that have the potential to cause harm to human health and three pollutants that have the potential to affect vegetation and ecosystems. Of the ten pollutants that have the potential to cause harm to human health, seven of these are associated with local air quality (benzene, 1,3-butadiene, carbon monoxide, lead, sulphur dioxide, nitrogen dioxide (NO_2) and particulate matter of under 10µm in aerodynamic diameter (PM_{10})). The Air Quality Standards Regulations sets standards and objectives for these pollutants. These objectives aim to reduce the health impacts of the pollutants to negligible levels. The most important pollutants with regard to emissions from vehicles are NO_2 and PM_{10} (The latter is also released during dust generating activities such as construction and the handling of dry materials).

30. The air quality objectives and limit values currently applying to the UK can be split into two groups. Each has a different legal status and is therefore handled differently within the framework of UK air quality policy. These are:

- UK air quality objectives set down in regulations for the purposes of local air quality management; and
- European Union (EU) limit values transcribed into UK legislation.

31. The EU has set mandatory limit values for a range of pollutants, including PM_{10} and NO_2. These limit values are similar to the Air Quality Standards Regulations objectives discussed as follows.

9.2.4.2 European Air Quality Directives

32. Council Directive 2008/50/EC on ambient air quality and cleaner air for Europe "the CAFE Directive", defines the policy framework for air pollutants known to have a harmful effect on human health and the environment. It replaced Council Directive 96/62/EC on ambient air quality assessment and management, Council Directive 1999/30/EC relating to limits for sulphur dioxide, nitrogen dioxide, oxides of nitrogen, particulate matter and lead in ambient air, Council Directive 2000/69/EC relating to limit values for benzene and carbon monoxide in ambient air and Council Directive 2002/3/EC relating to ozone in ambient air. Directive 2008/50/EC amends Directive 96/62/EC, on ambient air quality assessment and management; Decision 97/101/EC, establishing a reciprocal exchange of information

and data from networks and stations measuring ambient air pollution within Member States; Directive 99/30/EC, on limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air; Directive 2000/69/EC, on limit values for benzene and carbon monoxide in ambient air; and Directive 2002/3/EC, relating to ozone in ambient air.

9.2.4.3 Pollutants of Concern

Nitrogen Dioxide

33. The UK Government and the Devolved Administrations adopted two Air Quality Objectives for NO_2 to be achieved by the end of 2005. From 2010, mandatory EU air quality limit values on pollutant concentrations apply in the UK. The EU limit values for NO_2 are the same as the national objectives for 2005:

- An annual mean concentration of 40 micrograms per cubic metre ($\mu g/m^3$); and
- An hourly mean concentration of 200$\mu g/m^3$, to be exceeded no more than 18 times per year.

34. In practice, meeting the annual mean objective has been and is expected to be considerably more demanding than achieving the 1-hour objective. The annual mean objective of 40$\mu g/m^3$ is currently widely exceeded at roadside sites throughout the UK, with exceedences also reported at urban background locations in major conurbations. The number of exceedences of the hourly objective show considerable year-to-year variation, and is driven by meteorological conditions, which give rise to winter episodes of poor dispersion and summer oxidant episodes. The air quality objectives have been set with regard to the adverse effect of NO_2 on human health, such as exacerbating existing respiratory problems.

35. National projections for 2010 indicate that the mandatory EU limit value may be exceeded at urban background sites in London, and at roadside locations in other towns and cities throughout the UK.

36. NO_2 and nitric oxide (NO) are both oxides of nitrogen, and are collectively referred to as NO_X. All combustion processes produce NO_X emissions, largely in the form of NO, which is then converted to NO_2, mainly as a result of its reaction with ozone in the atmosphere. Therefore, the ratio of NO_2 to NO is primarily dependent on the concentration of ozone and the distance from the emission source.

37. The First EU Daughter Directive (1999/30/EC) sets a Limit Value for NO_X for the protection of vegetation (an annual mean of 30$\mu g/m^3$) to be met by 2001. This value was based on the work of the United Nations Economic Commission for Europe (UNECE) and World Health Organisation (WHO), and incorporated into the UK Air Quality Standards Regulations 2007 (Defra, 2007) revoked and replaced by the Air Quality Standards Regulations 2010. The policy of the UK statutory nature conservation agencies is to apply the 30$\mu g/m^3$ criterion within internationally designated conservation sites and ASSIs on a precautionary basis.

Particulate Matter

38. Particulate matter is composed of a wide range of materials arising from a variety of sources. Particulate matter is typically assessed as total suspended particulates or as a mass size fraction. National and European objectives/limit values apply for the PM_{10} and $PM_{2.5}$ fractions. These express particulate levels as the total mass size fraction at or below an aerodynamic diameter of 10 and 2.5µm respectively.

39. Two objectives have been adopted for PM_{10}, which were to be achieved by the end of 2004:

- An annual mean concentration of 40$\mu g/m^3$; and
- A 24-hour mean concentration of 50$\mu g/m^3$ to be exceeded no more than 35 times per year.

40. Two health based objectives have been adopted by the EU for particles of under 2.5µm in diameter ($PM_{2.5}$):

- An annual mean concentration of 25µg/m^3 to be achieved by 2010; and,
- A 15% reduction in annual mean concentration between 2010 and 2020.

41. However, modelling tools have not yet been made available for the $PM_{2.5}$ fraction and a worst-case scenario may be used whereby the modelled concentration of PM_{10} is compared subjectively with the $PM_{2.5}$ objectives.

42. Both short-term and long-term exposure to ambient levels of particulate matter are consistently associated with respiratory and cardiovascular illness and mortality as well as other ill-health effects. Particles of less than 10µm in diameter have the greatest likelihood of reaching the thoracic region of the respiratory tract.

43. It is not currently possible to discern a threshold concentration below which there are no effects on the whole population's health. Recent reviews by WHO and the Committee on the Medical Effects of Air Pollutants (COMEAP, 1998) have suggested exposure to a finer fraction of particles ($PM_{2.5}$, which typically make up around two thirds of PM_{10} emissions and concentrations) give a stronger association with the observed ill health effects, but also warn that there is evidence that the coarse fraction (between PM_{10} - $PM_{2.5}$) also has some effects on health.

44. Industrial processes and road transport were the main sources of PM_{10} in 2005. In general, diesel vehicles emit a greater mass of particulate per vehicle kilometre than petrol-engine vehicles (AEA, 2007). Emissions of PM_{10} have decreased considerably since 1970, mainly due to the decline in coal use and the result of legislative and technical control of emissions from both road traffic and industrial sources. There are concerns, however, that significant uptake of biomass technology utilising wood fuel could lead to detrimental impacts upon air quality with regards to emissions of particulate matter.

Construction Dust

45. Dust is defined as all particulate matter up to 75µm in diameter and comprising both suspended and deposited dust, whereas PM_{10} is a mass fraction of airborne particles of diameter of 10µm or less. The health impacts associated with dust include eye, nose and throat irritation in addition to the nuisance caused by deposition on cars, windows and dwelling. Dust and PM_{10} emissions arise from a number of sources, so both demolition and construction activities and emissions from vehicles associated with the site should be considered.

9.2.4.4 Climate Change

46. The management of emissions with the potential to contribute to global climate change is increasingly important on a national and international basis, and man-made emissions are recognised as a significant cause of climate change by the most recent findings of the Intergovernmental Panel on Climate Change (IPCC).

47. The International Kyoto Protocol was agreed in 1997 in response to rising emissions of the principal gases contributing to global warming, which are considered to be long-lived greenhouse gases such as carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4). CO_2 arises from a range of sources including the combustion of fossil fuels. The Kyoto Protocol was subsequently ratified by the EU in 2005, under which the UK agreed to the burden sharing agreement within the EU to limit emission.

48. In the UK, the Climate Change Act enacted the Climate Change Act of 2008, mandating national emissions reductions (Crown 2008). In December, 2008 the United Kingdom's Committee on Climate Change (created by the Act) released a report recommending that national greenhouse gas emissions be reduced by at least 80% by 2050 and by 34% by 2022 (or 42% if an international agreement on climate change is reached) (Committee on Climate Change 2008). The Committee's report, "The Appropriateness of a Northern Ireland Climate Change Act" was published in November 2011 and sets out the benefits of the legislation.

49. Since 2011, the Department of the Environment has released annual greenhouse gas emission reports with the latest published in 2014. The conclusion of which states, *"Progress in meeting the GHG emissions reduction target set by the Executive remains slow this year with the Greenhouse Gas Inventories indicating that up until 2011 Northern Ireland emissions have reduced by 17.5%. This is reflected in the latest projections to 2025 showing a fall in emissions reduction to 27.6% from 28.3% in the previous year."* (DOE, 2014).

Climate Change and Biodiversity

50. The Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment[75] aims to help Member States improve the way in which climate change and biodiversity are integrated in Environmental Impact Assessments (EIA). The document states (Page 11):

> *"The guidance addresses the specific issues and challenges that climate change and biodiversity bring to EIA. It is designed to encourage users to think about how important climate change and biodiversity issues are likely to be for their specific project and EIA. It also includes issues related to disaster risk management, mainly in the context of climate change adaptation."*

51. With regard to climate, one of the stated principal benefits of the Tyrone – Cavan Interconnector is that it will support the development of renewable power generation[76]:

> *"This will enable the connection and operation of larger volumes of renewable power generation (especially wind-powered generation) throughout the island and in turn help to facilitate meeting targets for renewable generation".*

52. A key constraint to the full development of wind-powered generation is the ability of the existing transmission systems to absorb and manage this form of power generation. Consented wind energy developments often struggle to connect because of current infrastructure weaknesses. Whilst the potential for wind power is evident, the costs and complexities associated with expanding and modifying the transmission systems will present significant infrastructural challenges in the years ahead. The All-Island Grid Study report[77] observed that *"timely development of the transmission system"* is a precondition for implementation of the available potential generation from wind resources.

53. It will not be possible to deliver the full potential of wind power generation in both Northern Ireland and the Republic of Ireland without significant additional transmission system interconnection. The proposed interconnector will be a significant step towards addressing this issue by allowing power sourced from renewable generation to access demand and other interconnectors on both parts of the all island network.

54. In terms of the Tyrone – Cavan Interconnector, the potential increased flood risk from climate change has been included in the assessment within the Consolidated ES. The Rivers Agency flood map was a key reference source for the Flood Risk Assessment that has been undertaken for the Tyrone – Cavan Interconnector. The Rivers Agency has allowed for the potential climate change impacts in its data and it is stated that[78]:

> *"…the Climate Change map layer [of the Rivers Agency Strategic Flood Mapping] has*

[75] European Commission. 2013. Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment.

[76] Consolidated ES. May 2013. Volume 2, Chapter 2, Page 6, Paragraph 3.

[77] (DETI, DCEMNR, January 2008)

[78] http://www.dardni.gov.uk/print/index/rivers/strategic-flood-map-ni/overview-strategic-flood-map/production-and-purpose-strategic-flood-map-faqs.htm

been produced to reflect the flood plain outlines for the year 2030 and this is based on the best available predictions for the meteorological conditions and sea levels at that time".

55. The potential climate change impacts to the towers and associated works have therefore been considered in the Consolidated ES.

56. The substation infrastructure has been designed to be outside of the Q200 floodplain with additional freeboard to provide additional resilience. The drainage strategy for the Tyrone – Cavan Interconnector does include a 20% increase in rainfall intensity climate change allowance in the assessment and design, which is in accordance with UKCIP[79] predictions. Therefore there are no likely significant effects with regard to the proposed substation site.

57. The project design has ensured that the Tyrone – Cavan Interconnector will operate within a wide range of climatic conditions and any potential climate change impacts will not affect its normal operation.

58. The EIA for the Tyrone – Cavan Interconnector has considered the likely significant effects to ecology (and therefore biodiversity) in the Consolidated ES. It was stated in that assessment that[80]:

"The Proposed Development covers a large area of land but has a small footprint and therefore the potential for effects is low. Permanent land take is low and habitats lost are generally of low ecological value. Animals quickly habituate to new infrastructure in the environment and with mitigation the long term effects on biodiversity will be negligible."

59. The assessment of the Tyrone – Cavan Interconnector has considered potential changes to the environment by comparing the Do Nothing scenario (i.e. situation without the Tyrone – Cavan Interconnector) to the Do Something scenario (i.e. situation with the Tyrone – Cavan Interconnector). This assessment is based on the current understanding of the existing environment. It is considered that the Tyrone – Cavan Interconnector will not have likely adverse significant effects in terms of contributing to climate change and it is unlikely to be significantly affected by climate change impacts. The Tyrone – Cavan Interconnector will facilitate the connection of renewable energy sector on the island of Ireland and so will facilitate a beneficial impact in terms of climate change. Any changes to biodiversity as a result of climate change would occur in the Do Nothing scenario and it is considered that the Tyrone – Cavan Interconnector will not contribute to any possible changes.

9.3 Baseline Conditions

9.3.1 Sensitive Receptors

60. The Local Air Quality Management (LAQM) responsibilities are undertaken by the Local Councils. Armagh, Banbridge and Craigavon District Council has declared two Air Quality Management Areas (AQMAs) in the city of Armagh, whilst Mid Ulster Council has declared four AQMAs (two in Dungannon, one in Coalisland and one AQMA in Moy).

61. The Tyrone - Cavan Interconnector is not located near any existing AQMAs, and is not within 200m of any ecological designated sites (the proposed substation is 3.6km from the Lough Neagh and Lough Beg Ramsar boundary).

62. The nearest extant residential dwelling to the Tyrone - Cavan Interconnector is 55m from the centreline of the overhead line. However the nearest extant residential dwelling to a working area (tower base) is

[79] UK Climate Impacts Programme

[80] Consolidated ES. May 2013. Volume 2, Chapter 10, Page 367, Paragraph 347.

approximately 85m. Section 1 of this Addendum identifies a consented residential planning application near to T47. If constructed as consented, this dwelling would be 49m from the centreline of the overhead and 80m from the working area of T47.

63. There are no other sensitive receptors (such as hospitals, schools, residential care homes, etc.) within 200m of the centreline of the Tyrone - Cavan Interconnector. There is a day nursery approximately 900m from the Tyrone - Cavan Interconnector and a primary school approximately 700m away.

64. The proposed haul routes for traffic accessing some of the tower construction sites (see Chapter 18 Transport of the Consolidated ES) associated with the Tyrone - Cavan Interconnector will pass through two AQMAs and within 200m of two designated ecological sites. These are:

- Moy AQMA (In the Mid Ulster Council area);
- Armagh AQMA – A29/A3 (In the Armagh, Banbridge and Craigavon District Council area);
- Lough Neagh and Lough Beg Ramsar and Special Protection Area (SPA) (immediately adjacent to the M1, which will be used as a haul route) ; and,
- Drumcarn Area of Special Scientific Interest (ASSI).

9.3.2 Background Pollution

65. No air quality monitoring is undertaken by the Councils near the Tyrone - Cavan Interconnector.

66. A large number of sources of air pollutants exist which individually may not be significant, but collectively, over a large area, need to be considered.

67. Modelled estimations of background air quality concentrations are provided by Defra (Defra 2014) for each 1 km square in the UK for each year between 2010 and 2030. Estimated background concentrations for the grid square containing the Turleenan substation (97500, 516500) for 2014 are provided in Table 9.13. These data were downloaded in April 2014.

68. The data in Table 9.13 are broadly representative of background concentrations throughout the route as it is rural for the whole length, and generally similar to the area around the proposed substation. The annual mean concentrations estimated by Defra were very low and well below the annual mean objectives.

Table 9.13: Defra Estimated 2014 Background Pollution Concentrations, μg/m^3

Pollutant	Concentration
NO_X	4.9
NO_2	3.8
PM_{10}	10.3
$PM_{2.5}$	6.4

9.4 Predicted Impacts

9.4.1 Construction Air Quality Impacts

69. The assessment considered the effects due to construction dust and vehicle exhaust emissions that may occur during the construction phase of the Tyrone - Cavan Interconnector.

70. According to the EPUK document ‘Development Control: Planning for Air Quality’ (EPUK, 2010), an air quality assessment is required for ‘large, long term construction sites that would generate HGV flows of more than 200 movements per day over a period of a year of more’. The numbers of construction vehicles are considered to be significantly lower than this threshold.

71. Construction traffic will use local roads to access the working areas. It is predicted that there will be relatively large percentage increases of traffic flow on some local roads, although this is predominantly due to the very low existing flow volumes (see Chapter 18 Transport of the Consolidated ES).The work and hence impacts will be temporary, and as none of the AQMAs are designated for the short-term objectives (e.g. hourly NO_2 or daily PM_{10}), and the numbers of construction vehicles will not breach the thresholds, it is considered that there will be no significant air quality effects due to construction vehicle emissions.

72. As summarised in Section 9.2.1 above, a four step process was followed to determine the risk of potential impacts during the construction phase. The results of this process are presented in the following sections.

9.4.1.2 Step 1: Screen the requirement for a more detailed assessment

73. The condition of the existing site is described as a rural hinterland with many scattered farms, dwellings and small commercial buildings. A few small villages are located along secondary and minor roads and around local educational or commercial centres. The land within the study area is primarily agricultural, consisting of low rolling hills, shallow valleys and structured fields, which often have overgrown hedgerows and many mature trees.

74. Areas of significant conservation interest, such as species-rich grassland, river channels, bogs and wetlands have been avoided, and so the construction of the overhead line route will not involve any earthworking or other significant activities within or near any sensitive international, European, national or locally designated ecological sites. The proposed Turleenan substation in County Tyrone is over 3km from any sensitive designated ecological site.

9.4.1.3 Step 2A – Define the Potential Dust Emission Magnitude

75. The assessment for each stage has been divided into the two main components of the project; construction of the proposed Turleenan substation, and construction of the overhead line towers and associated works.

76. The estimated construction period for the entire overhead line route has been estimated as three years from the start of the site works, but the construction period at any particular location along the overhead line route would be in the order of four to six months.

77. The development site for the Turleenan substation is proposed to be approximately 193m x 134m. The proposed ancillary works will principally include an access road, surrounding earthworks, land contouring and landscape planting.

78. The proposed overhead line towers will be located at intervals of approximately 336m (average value) along the overhead line route. Materials for construction will be stored at Carn depot, NIE's main regional depot which is close to Craigavon. The maximum foundation size of 25m in length x 25m in width (proposed 275 kV tower at Turleenan substation – the majority will be smaller than this), will require excavation for each tower footing that will be filled with concrete and steel to form a foundation, with excess material being reused or removed from site. No construction activity will occur at the Carn depot, although the majority of traffic movements related to the project are expected to occur between this depot site and the main construction site at the Turleenan substation. This is considered in the track-out component.

<u>Demolition</u>

79. One derelict farm building and one dwelling on Turleenan substation site will be demolished once the site is nearing completion. However, there is not proposed to be any other significant demolition works. Therefore, this component is classified as **Negligible**.

Earthworks

80. The proposed Turleenan substation will cover an area of greater than 10,000m^2 (see Table 9.3). Earthworks, grading and landscaping will be undertaken, as well as haulage and stockpiling of materials. Therefore, according to Table 9.4, it is considered to have a **Large** magnitude of potential dust emissions.

81. Each tower foundation has a footprint of less than 2,500m^2 (400m^2 - this area is defined as 'small' in Table 9.2). Therefore, by taking into consideration the type of activities proposed the potential dust emission classification is considered to be **Small**. The proposed overhead line towers will be widely spread, with spacing between the towers ranging from approximately 158m to 476m and will on average be approximately 336m. Therefore, they will generally be sufficiently widely spread that adjacent sites will not cause any cumulative effects.

Construction

82. The majority of the construction work will take place at the proposed Turleenan substation. High dust-generating activity, such as piling, is not expected to be required. Therefore, according to Table 9.4 the potential dust emission classification is predicted to be **Medium**.

83. The construction work at the overhead line towers will mainly comprise concrete pouring the foundations, and subsequently building the metal framework. Concrete will be mixed off-site and batching will not occur locally. This stage is considered to have a **Small** dust emission classification.

Track-out

84. The greatest number of vehicle movements will be associated with the vehicles using the NIE depot in Carn. This will not result in more than 180 movements per day, including staff cars, vans, HGVs and construction vehicles.

85. This does not exceed the criteria for numbers of HGV movements defined by the DMRB, Volume 11, Section 3, Part 1 HA 207/07 (HA, 2007) and therefore a quantitative assessment is not required and the impacts due to vehicle emissions during this phase should be considered **Insignificant**.

86. With regard to the criteria for the dust-generating potential of the surface material and the length of unpaved road in Table 9.5, it is considered to be a conservative approach to classify the potential dust effects as from the Turleenan substation as **Medium**, and from the overhead line tower sites as **Small**.

87. A summary of the dust emission magnitude for each activity is provided in Table 9.14.

Table 9.14: Summary of the Dust Emission Magnitude

Source	Dust Emission Classification	
	Turleenan Substation	Overhead Line Towers
Demolition	Negligible	Negligible
Earthworks	Large	Small
Construction	Medium	Small
Track-out	Medium	Small

9.4.1.4 Step 2B – Define the Sensitivity of the Area

88. The following were taken into consideration when determining the sensitivity of the area to dust soiling and health effects of PM_{10} in accordance with the assessment criteria and Tables 9.6 – 9.8.

89. With regard to the Turleenan substation:

- Construction site is in a rural area with few residential dwellings located nearby and therefore the receptors are considered to be **Low** sensitivity
- There are no dwellings within 20m of the construction boundary or working areas.
- No PM_{10} monitoring is undertaken in the vicinity of the proposed site; however, the Defra modelled background concentrations indicate that PM_{10} concentrations are < 24 µg/m^3 (approx. 10 µg/m^3)
- There are no designated ecological sites sensitive to dust or air quality within 50m of the construction boundary or working areas.

90. Taking the above into consideration the sensitivity of the area to dust soiling effects is **Low** (see Table 9.6), **Low/Medium** for health effects (see Table 9.7) and **Negligible** for ecological effects (see Table 9.8).

91. With regard to the overhead line towers:

- Working areas are in predominantly rural locations, with few residential dwellings located nearby and therefore the receptors are considered to be **Low** sensitivity;
- The nearest dwelling (consented planning application near to T47) to the tower base/working areas is 80m away, as the Tyrone - Cavan Interconnector was specifically routed and spaced to avoid dwellings;
- The construction of temporary access tracks, stringing operations, guarding locations, vegetation clearance are not considered to be significant;
- No PM_{10} monitoring is undertaken in the vicinity of the proposed sites; however, the Defra modelled background concentrations indicate that PM_{10} concentrations are < 24 µg/m^3 (approx. 10 µg/m^3); and,
- There are no designated ecological sites sensitive to dust or air quality within 50m of any of the tower working areas. The Lough Neagh and Lough Beg Ramsar is immediately adjacent to the M1 which will be used as a haulage route. Given the relative small increase in traffic that will result from the construction phase, it has been determined that there will be no impact to the Ramsar site. Further assessment is made within the shadow HRA for the project.

92. Taking the above into consideration the sensitivity of the area to dust soiling effects is **Low** (see Table 9.6), **Low/Medium** for health effects (see Table 9.7) and **Negligible** for ecological effects (see Table 9.8).

9.4.1.5 Step 2C – Define Risk of Impacts

93. Taking into consideration the conclusion from Steps 2A and 2B, the resultant predicted risk of dust impacts for each activity are provided in Table 9.15.

Table 9.15: Risk of Unmitigated Dust Impacts

Source	Turleenan Substation			Overhead Line Towers		
	Dust Soiling	Human Health	Ecological	Dust Soiling	Human Health	Ecological
Demolition	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Earthworks	Low	Medium	Negligible	Low	Low	Negligible
Construction	Low	Medium	Negligible	Negligible	Low	Negligible
Track Out	Low	Low	Negligible	Negligible	Negligible	Negligible

9.4.2 Climate Change Effects

94. The Tyrone - Cavan Interconnector will result in the emission of greenhouse gases during the construction phase, for example carbon dioxide emissions associated with the transportation of construction materials and the consumption of raw materials. However, these emissions are unlikely to be significant compared to the facilitated emissions reductions expected once operational, as discussed below.

95. During the operational phase, the Tyrone - Cavan Interconnector as a whole is intended to improve the market for renewable energy generation by enhancing the flexible exchange and improved transmission of electricity between Northern Ireland and the Republic of Ireland. This will increase the ability for renewable power generation sources, which may not operate at typical times of high demand (e.g. wind) to access more flexible demand across a larger network. The potential change of emissions that will be facilitated due to the operation of the Tyrone - Cavan Interconnector have not been quantified as part of this appraisal, but the change is expected to be beneficial on a national and regional scale. This will support UK and Northern Ireland government objectives and climate change commitments by promoting uptake of alternative and renewable energy sources across a wide geographical area.

9.4.3 Air Quality Operational Phase Effects

96. The operation and maintenance of the Tyrone - Cavan Interconnector will not result in any significant impact on air quality impacts. There will be no emissions from the towers or overhead line and any associated maintenance traffic will be very low – one vehicle trip to the tower locations every two years, and vehicles associated with the vegetation clearance 5-year cycle. At the proposed substation, a maximum of two vehicles per day is anticipated during operation and three or four per day during maintenance, which will normally take no longer than one week each year (see Chapter 5 Proposed Development and Chapter 18 Transport of the Consolidated ES for further details).

9.5 Mitigation and Enhancement Measures

97. The impacts associated with the construction of the overhead line towers were predicted to be low/negligible, although impacts associated with the construction of the Turleenan substation were medium, with the greatest impacts due to earthworks and construction activities. However, regardless of the potential impacts, it is considered good practice to ensure that robust mitigation controls are in-place to ensure that impacts are further minimised or eliminated.

98. A number of mitigation measures can be adopted to reduce the production and/or dispersal of dust to lessen the nuisance and limit the human health impacts. The Construction Management Plan will include detailed mitigation measures which will ensure dust related activities and their impact are minimised. Appropriate mitigation for each stage of the works is recommended by the IAQM (2014) Guidance on the Assessment of Dust from Demolition and Construction. Appropriate controls based on the level of risk for each activity have been summarised in Table 9.16. These measures will be undertaken as part of the construction phase of the Tyrone - Cavan Interconnector.

99. With regard to weather conditions, water sprays will be used with regard to wind speeds and the likelihood of material being windblown or tracked off-site.

100. The proposed haul routes for traffic accessing some of the tower construction sites associated with the Tyrone - Cavan Interconnector will pass through two AQMAs and within 200m of two designated ecological sites. These locations are sensitive to vehicle emissions, and so vehicle routeing plans will be implemented to minimise the number of HGV movements (through consolidation of loads and avoiding rush hours as far as possible) through or near to these sensitive locations.

Table 9.16: Air Quality Mitigation Measures

Mitigation	Actions
Communication	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary, and the regional office contact information.
	Develop and implement a Dust Management Plan (DMP) as part of the CEMP.
Site Management	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
	Make the complaints log available to the local authority when asked.
	Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.
Monitoring	Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby to monitor dust and record inspection results.
	Carry out regular site inspections to monitor compliance with the CEMP and record inspection results.
	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
Preparation	Plan site layout so that machinery and dust causing activities should be located away from receptors as far as is possible.
	Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any permanent stockpiles on site.
	Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period.
	Avoid site runoff of water or mud.

Mitigation	Actions
	Keep site fencing, barriers and scaffolding clean using wet methods.
	Remove materials that have a potential to produce dust from site as soon as possible.
	Cover, seed or fence long-term stockpiles to prevent wind whipping.
Operating Vehicles	Ensure all vehicles switch off engines when stationary with no idling vehicles.
	Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
	Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas.
	Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
General Operations	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction.
	Ensure an adequate water supply on the site for effective dust suppression.
	Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
Demolition	Ensure effective water suppression is used during demolition operations.
	Bag and remove any biological debris or damp down such material before demolition.
Earthworks	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
	Use Hessian or mulches where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.
	Only remove the cover in small areas during work and not all at once.
Construction	Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
	Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
	For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.

Mitigation	Actions
Trackout	Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.
	Avoid dry sweeping of large areas.
	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
	Record all inspections of haul routes and any subsequent action in a site log book.
	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).

(summarised from IAQM, 2014)

101. The Outline Construction Environmental Management Plan (CEMP) has been revised to include these mitigation measures (and those from the other chapters). The revised Outline CEMP is presented as Appendix 9.1 of this addendum.

9.6 Residual Impacts

102. The impacts associated with the construction phase of the Tyrone - Cavan Interconnector have been qualitatively assessed with reference to the Institute of Air Quality Management (IAQM) 'Guidance on the Assessment of Dust from Demolition and Construction' (IAQM, 2014).

103. The IAQM guidance states that: *"in the case of demolition / construction it is assumed that mitigation (secured by planning conditions, legal requirements or required by regulations) will ensure that a potential significant adverse effect will not occur, so the residual effect will normally be 'not significant'"*. Therefore, overall it is considered that the impacts during the construction phase will be of **'Negligible'** significance.

104. The proposed haul routes for traffic accessing some of the tower construction sites associated with the Tyrone - Cavan Interconnector will pass through two AQMAs and within 200m of two designated ecological sites:

- Moy AQMA (In the Mid Ulster Council area);
- Armagh AQMA – A29/A3 (In the Armagh, Banbridge and Craigavon District Council area);
- Lough Neagh and Lough Beg Ramsar and Special Protection Area (SPA) (immediately adjacent to the M1, which will be used as a haul route) ; and,
- Drumcarn Area of Special Scientific Interest (ASSI).

105. Therefore, vehicle routeing plans will be implemented to minimise the number of HGV movements through or near to these sensitive locations. Because of the limited number of construction vehicles compared to existing traffic conditions at these locations there will be no likely significant effect to the areas.

106. The operation and maintenance of the Tyrone - Cavan Interconnector will not result in any significant impact on air quality impacts.

107. The Tyrone - Cavan Interconnector will have climate change effects during the construction phase due to the emission of greenhouse gases. However, these emissions are unlikely to be significant over the lifetime of the Tyrone - Cavan Interconnector. During the operational phase, the development as a whole is intended to improve the uptake of renewable energy generation. Greenhouse gases will be

emitted during the construction phase, although these emissions are unlikely to be significant compared with the facilitated emissions reductions expected once operational. The potential change of emissions that may occur due to the operation of the Tyrone - Cavan Interconnector have not been quantified as part of this appraisal, but the change is expected to be **beneficial** on a long-term national and regional scale.

9.7 Conclusions

108. An assessment was undertaken to consider the potential local air quality effects during the construction of the proposed Turleenan substation and overhead line towers.

109. The greatest potential dust-generating impacts were predicted to be Medium, due to earthworks and construction activity at the Turleenan substation site. Road vehicle emissions were predicted to be Negligible.

110. The potential dust-generating impacts due to the construction of the overhead line towers and associated works were predicted to be low or negligible due to the distance from residential and ecological receptors from the construction areas and small size of the individual sites.

111. Appropriate construction dust mitigation controls and constructing vehicle routing will be implemented and the residual effect will be 'not significant'.

112. Greenhouse gases will be emitted during the construction phase, although these emissions are unlikely to be significant compared with the facilitated emissions reductions expected once operational. During the operational phase the Tyrone - Cavan Interconnector will increase transmission capacity and facilitate renewable energy sources, such as wind, by improving access to the end market. This will support government objectives and climate change reduction commitments. The operation and maintenance of the Tyrone - Cavan Interconnector will not result in any significant air quality impacts.

9.8 References

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Chapter 10 Technology Alternatives



Main Text Volume 2

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SONI
Tyrone Cavan
Interconnector

The current. The future.

10 Technology Alternatives

10.1 Introduction

1. This chapter of the Consolidated ES Addendum sets out the context in which the main alternatives were considered by SONI and EirGrid for the proposed interconnector and an indication of the main reasons for the final project chosen, taking into account the effects on the environment.

2. It outlines the main transmission and technology alternatives considered for the project and addresses the Technology Alternatives and methods for delivery considered appropriate for transmission interconnection design, capacity and circuit operation.

3. This chapter also outlines the key findings of the Partial Undergrounding Report (Appendix 10.2). This is an assessment of the potential for the use of partial undergrounding as a mitigation measure in areas of significant landscape impacts. EirGrid was requested to provide this report by An Bord Pleanála, in its role as the competent authority for Projects of Common Interest (PCI) in Ireland, during the PCI pre-application process. The report was prepared jointly by SONI and EirGrid because in the interest of completeness it necessarily considers the overall interconnector development including that part located in Northern Ireland.

4. The chapter is structured as follows:

- Section 10.1 Introduction
- Section 10.2 Alternative Technologies, which include –
  - Alternatives to Transmission Network Solutions
  - Transmission System Limitations and Consequences
  - Potential Alternatives for Addressing the Emerging Shortfall in Generation Capacity in Northern Ireland
  - Project Objectives / Design Criteria
  - Specific Studies Commissioned by the Respective Applicants on Alternative Transmission Technologies
  - Further Specific Technical Studies and Reports of Direct Relevance to the Proposed Interconnector
  - Other Third Party Reports to Note
  - Transmission Technology Alternatives Considered for the proposed interconnector
  - Consideration of High Voltage Alternating Current (HVAC) Options
  - Partial Undergrounding of AC Transmission Circuits
- Section 10.3 Partial Undergrounding as Landscape Mitigation.

10.2 Alternative Technologies

10.2.1 Alternatives to Transmission Network Solutions

5. The ‘all-island’ Single Electricity Market (SEM) structure has been designed with the electricity supply chain separated into three fundamental parts:

- Power generation (production);

- Electricity transmission and distribution (delivery); and
- Electricity supply (retail sales).

6. This market structure relies fundamentally upon the transmission and distribution network infrastructure to link the sources of electricity production to the points of electricity demand. The owners and operators of the networks on the island of Ireland are required, under their respective Licences, to provide generators and suppliers with effective and efficient pathways for the delivery and sale of electricity to electricity users, if the cross-border transmission network is not developed, the following considerations become relevant.

10.2.2 Transmission System Limitations and Consequences

7. The existing Louth-Tandragee 275 kV double circuit OHL forms the primary existing interconnection pathway between Northern Ireland and Ireland, but further and more effective interconnection arrangements are required to meet the three strategic objectives of:

   i. Improving all-island electricity market competition;

   ii. Improving the security of supply; and

   iii. Supporting the development of renewable generation.

8. Due to the fact that both of the existing 275 kV interconnection circuits are supported on the same set of structures, there is a real risk that they could both be forced out of service simultaneously by a single event. Such a loss of interconnection would bring about an electrical separation of the transmission networks in Northern Ireland and Ireland and depending upon the operating conditions at the time, could lead to widespread outages of electricity supply and the potential collapse of the importing transmission network.

9. The risk of such an event is unacceptable, and for this reason the Transmission System Operator (TSO) currently imposes a transfer capacity restriction on the existing Interconnector. This ensures that if there is a sudden loss of the interconnector, the shock to the network is limited to a level that can be managed without widespread black-outs.

10. Without additional interconnecting circuits the risk of system separation will continue, and consequently any potential benefit from increased rated capability for power transfer of the existing 275 kV or 110 kV lines could not be realised i.e. through conductor replacement or new power flow management devices.

11. The restriction described creates a ‘bottleneck’ in the network, seriously limiting the scope for commercial exchanges of electricity between generators and suppliers in each part of the all-island electricity market, and leading to inefficiencies and costs that are passed through to final customers as part of their electricity prices.

12. Another issue of increasing concern is that future reductions in generation capacity within Northern Ireland could lead to a shortfall in available electricity supply in the years beyond 2016. In these circumstances, the ‘bottleneck’ described, which limits the ability of the network to transfer electricity from available spare power generation capacity in the south, could seriously threaten electricity supply security in Northern Ireland.

10.2.3 Potential Alternatives for Addressing the Emerging Shortfall in Generation Capacity in Northern Ireland

10.2.3.1 Potential Alternative: New Conventional Generation in Northern Ireland

13. One measure to reduce the impact of the transmission capacity restrictions described could be to build further generation in Northern Ireland.

14. It is conceivable that a new conventional generation plant constructed in Northern Ireland would improve security of supply issues in the medium term; however, it must be recognised that investment in new generation is at the discretion of independent commercial ventures, and market forces have not produced any proposal for new conventional generation to date.

15. Enforcing the construction of a new power station to improve security of supply in Northern Ireland could not be achieved without creating fundamental distortions in the Single Electricity Market (SEM). Such distortions would, in their turn, have a consequential adverse impact on other existing generators, further jeopardising future investment in generation.

16. It should also be noted that this solution to electricity security concerns would not address either of the other two primary strategic needs, i.e. improving market competition or enabling the increased use of renewable energy.

17. The addition of further power generation capacity in Northern Ireland, without addressing the need to transfer and exchange power flows across the border, would further exacerbate distortions in the electricity market, and would perpetuate conditions in which all-island electricity prices would remain higher than necessary.

10.2.3.2 Potential Alternative: Longer Life for Existing Conventional Generation in Northern Ireland

18. The generation shortfall in Northern Ireland is exacerbated by European emission restrictions that are precipitating the closure of its existing generation before its mechanical end-of-life. It is possible that the closures could be deferred for a period by the introduction of time limited derogations such that certain generators may be able to continue to operate for a longer period of time. However, such a move would introduce significant market costs and would prolong elevated environmental emissions associated with the use of older plant. At best, it would also be a short term market solution, and would not therefore remove the need for additional interconnection.

19. It should also be noted that this potential solution to electricity security concerns would not address either of the other two primary strategic needs, i.e. improving market competition or enabling the increased use of renewable energy.

20. The life-extension of additional conventional generation in Northern Ireland, without addressing the need to transfer and exchange power flows across the border, would extend conditions in which all-island electricity prices would remain higher than they should be.

10.2.3.3 Potential Alternative: Increased Dependence on Renewable Energy

21. Whilst there are plans for further onshore and offshore renewable generation to connect in Northern Ireland and Ireland in future years, the intermittent nature of wind, wave or solar generation precludes it from being relied upon for secure electricity supplies in the way that conventional power stations are. The future connection of renewable sources of electricity generation would therefore not remove the need for a level of access to conventional generation in the SEM to supply NI electricity needs.

22. It is also important to note that investment proposals for renewable energy projects invariably depend upon an expectation that there will be a network pathway to transport the electricity produced to a party that wishes to purchase and use that electricity. If there is no development of increased interconnection capacity between Northern Ireland and Ireland and there are therefore continuing restrictions in access to the all-island network, then these restrictions will continue to limit the viability of investment cases for renewable energy, and will therefore limit the number of such developments that can be achieved in reality.

10.2.3.4 Conclusion on Non-Transmission Network Solutions

23. It is considered that to achieve the objectives listed above whilst avoiding the security of supply, economic and environmental risks discussed, there is no feasible or desirable alternative to the

development of a transmission network solution. The only way to meet the strategic needs whilst also delivering a downward pressure on electricity prices is to enhance the transmission interconnection capacity between Ireland and Northern Ireland.

10.2.4 Project Objectives / Design Criteria

24. In assessing technical alternatives for the design and construction of the proposed interconnection infrastructure, it is necessary to acknowledge the need for a technical solution that ensures a transmission system that, although connecting two separately owned systems within two separate jurisdictions, will be operated as an integrated transmission system and which will service a single integrated market in which operational constraints are minimised.

25. It is also a requirement of this development that the new interconnector connects between appropriately robust points on the transmission networks north and south of the border and that it be physically remote from the existing north-south interconnector.

26. Transmission alternatives were therefore considered against a number of key performance objectives which must be achieved regardless of the particular technological alternative that is actually employed. These objectives derive from the overall performance requirements of the proposed interconnector as described in Chapter 2 (Need) of the Consolidated ES, and also from EirGrid's and SONI's statutory obligations.

27. The objectives and / or design criteria for the proposed interconnector are to:-

a) Comply with all relevant safety standards;

b) Comply with all system reliability and security standards;

c) Provide an environmentally acceptable and cost effective solution;

d) Have a power carrying capacity in the region of 1,500 MW, and connect between appropriately robust points on the transmission networks north and south of the border;

e) Facilitate future reinforcement of the local transmission network in the north-east area of Ireland;

f) Facilitate future grid connections and reinforcements; and

g) Comply with 'Good Utility Practice'[81] or 'best international practice'.

28. The project objectives / design criteria outlined guide the consideration and assessment of the alternative technology options for the proposed interconnector.

10.2.5 Specific Studies Commissioned by the Respective Applicants on Alternative Transmission Technologies

29. The respective applicants have worked together over many years to jointly consider and assess the various technological alternatives available for the proposed second interconnector. In order to ensure that the development process was fully and properly informed with respect to the available

81 In this Chapter of the EIS the terms 'Good Utility Practice' and 'best international practice' are interchangeable. The term 'Good Utility Practice' is widely recognised and adopted as a policy, either voluntarily or by regulation, within the industry. The principle behind good utility practice is that electric utilities will adopt the practices and methods of a significant portion of utilities within a specified geographic boundary. In the case of SONI the relevant utilities are the 41 members of ENTSO-E (European Network of Transmission System Operators for Electricity) that are drawn from 34 countries in Western Europe.

It should also be noted that compliance with good utility practice does not preclude the use of innovative practices, methods or technologies; however, when such innovative practices, methods or technologies are under consideration, the accompanying risk of failure and consequence of such failure must also be considered.

technological alternatives (notwithstanding the initial presumption that OHL would represent a superior solution and that an acceptable OHL route could be identified for the proposed interconnector) the respective applicants jointly commissioned five studies to evaluate potential transmission alternatives specifically for the proposed interconnector. The main objective of the studies was to inform both companies about the latest available alternative transmission technologies, and also to assist the on-going consultative and planning processes relevant to the overall project as applicable to elements being proposed within each jurisdiction.

30. Four of these studies were informed by specific data on the actual technical characteristics of the transmission systems within each jurisdiction on the island of Ireland and by reference to the geographic locations and prospective routes applicable to the required transmission circuits. The studies were:

- The PB Power Preliminary Briefing Note (Parsons Brinckerhoff, Power Division [PB Power], 2008). A short report, published at an early stage in the project development process, drawing upon generic information to summarise in general terms the technical and cost issues associated with implementing the proposed transmission circuit.
- The PB Power Study (PB Power, 2009). A thorough report describing the conclusions drawn from a detailed study by PB Power following the publication of the Preliminary Briefing Note. The study was specific to the proposed project, and compared a high voltage OHL transmission option with UGC options utilising either HVAC or HVDC technologies.
- The TEPCO Study (TEPCO, 2009). A system wide study that considered the implications, for transmission system reliability and stability, of incorporating very long lengths, and large quantities, of High Voltage (HV) UGC transmission infrastructure on the all-island AC transmission network. The study was performed by Tokyo Electric Power Company of Japan (TEPCO) who, as owner and operator of the world's longest existing UGC circuit operating at a voltage of 400 kV or above, is uniquely placed to bring its specific experience to bear on the subject.
- The TransGrid Study (TransGrid, 2009). A system wide study that considered the implications for transmission system reliability and stability of incorporating HVDC circuits into the integrated all-island AC transmission network. This study was performed by TransGrid Solutions (of Winnipeg, Canada), a consultancy with extensive international experience in the evaluation of HVDC technology. The study included specifically an examination of the viability of using this technology for a second north-south interconnector.
- The PB Power Technology and Costs Update (PB Power, April 2013 and Supplementary Note July 2013 – the former as contained in the Consolidated ES and the latter provided as Appendix 10.1 of this Addendum). A report summarising the results of a further study carried out to update the information provided in the PB Power Study of 2009. This report includes a review of up to date technology and application developments worldwide. It also draws upon information and conclusions published within a number of recent relevant studies (including the IEC Report of 2012) into the subject of transmission technology alternatives. A key output from the updated study has been to provide up to date comparative costs for the identified alternatives.

31. The objectives of each of these studies, and the conclusions set out in each of the associated reports, are described in further detail in Table 10.1.

Table 10.1: Reports on Alternative Transmission Technologies Commissioned Jointly by the Respective Applicants

Report Title	Context of Report	Main Findings / Observations of Report
PB Power Preliminary Briefing Note - *Island of Ireland Cavan- Tyrone and Meath - Cavan 400 kV projects Preliminary Briefing Note Overhead and Underground Energy Transmission Options* Prepared by Parsons Brinckerhoff this was issued as an interim report **February 2008**	The *Preliminary Briefing Note* sets out a comparative overview of the technical and economic issues arising in respect of OHL and UGC transmission infrastructure options, with particular reference to the proposed Tyrone to Cavan element of the proposed interconnector. The document notes that both OHL and UGC technologies are proven in service, but includes a number of observations. The Briefing Note focused primarily on HVAC technology. The document did not include a review of HVDC technology because, at this early stage in the project, it appeared that the high land-take and high costs of terminal stations would not offer any benefits over the AC solutions.	UGC technology has not yet been tried anywhere in the world for an appropriate transmission infrastructure circuit approaching the route length of that proposed. HVAC OHL technology accounts for over 99% of Extra High Voltage (EHV) transmission infrastructure worldwide as it is considered to represent the best balance from an economic, technical and environmental perspective. UGC technology is noted to play an important role in urban and congested areas, or where site specific environmental constraints occur, for example within an area of outstanding scenic beauty. UGC technology is significantly more expensive than OHL technology. There can be considerable variation in cost ratios dependent upon the terrain and the circumstances. The Briefing Note stated that further work would be undertaken to examine the specific feasibility issues relevant to the prospect of undergrounding the proposed interconnector.
The PB Power Study - *Cavan-Tyrone and Meath-Cavan 400 kV Transmission Circuits Comparison of high-voltage transmission options: Alternating current overhead and underground, and direct current underground* Prepared by Parsons Brinckerhoff **February 2009**	This study considers use of Technology Alternatives for the proposed interconnector. It makes two sets of comparisons: • HVAC UGC as an alternative to the proposed HVAC OHL; and • HVDC UGC as an alternative to the proposed 400 kV HVAC technology. In each case the comparison of the technologies addresses routing feasibility, high-level environmental considerations, and the installation and cost differences that would be associated with the alternatives.	HVAC OHL transmission is the most widely used method of bulk power transfer in Europe and represents the lowest cost technically feasible approach to establishing and maintaining a secure electrical power grid. Global transmission development activity suggests that this preference by utilities for the use of OHLs is likely to persist into the future. The longest XLPE transmission cable (in the range 380 kV to 500 kV) is 40km and runs in a tunnel. If implemented using AC UGC the proposed interconnector would be the longest such cable circuit worldwide at approximately 135km. HVAC OHLs are susceptible to environmental effects and thus normally exhibit fault rates higher than those of UGC circuits. However, average repair times of UGC are much higher than those of OHL. High voltage UGC has the capacity to inflict considerable short term (construction period) and long term operational negative impact on the environment - however, mitigation measures can be put in place. Both high voltage OHL and UGC produce power frequency magnetic fields whose strengths would be directly proportional to the electrical load being carried at any instant. The insertion of a HVDC transmission circuit into the HVAC transmission network would introduce more system complexity than an HVAC OHL. Cost estimates for each option were calculated. The construction cost estimate for the UGC option was calculated by firstly identifying a potential route for the UGC alternative from County Meath to County Tyrone**;** then identifying the different types of landscape along this route as well as all rivers and roads that would have to be crossed; then calculating a cost per km per landscape

Report Title	Context of Report	Main Findings / Observations of Report
		type, a cost per major and per minor river and road crossing and using this data to build up a cost for installing UGC along the entire route. The cost of the OHL option was calculated by estimating a cost per km for 400 kV OHL (based on PB Power's international experience) and multiplying this by the length of the OHL in kilometres. Whole–of-project cost estimates (construction and lifetime running costs) for high voltage AC and DC UGC compared to 400 kV OHL shows OHL to be significantly more cost effective.
The TEPCO Technical Study *Assessment of the Technical Issues relating to Significant Amounts of EHV Underground Cable in the All-Island Electricity Transmission System* Prepared by Tokyo Electrical Power Company of Japan (TEPCO) **November 2009**	The respective applicants jointly commissioned TEPCO to undertake a system-wide study that considers the implications, for transmission system reliability and stability, of incorporating very long lengths, and large quantities, of HV UGC transmission infrastructure on the AC transmission network of the island of Ireland. The Study was carried out in 3 parts: Part 1: Evaluation of the potential impact on the all-island transmission system of significant lengths of EHV UGC, either individually or in aggregate. Part 2: Feasibility study on the 400 kV Woodland – Kingscourt – Turleenan line as AC UGC for the entire length. Part 3: Feasibility study of the 400 kV Woodland – Kingscourt – Turleenan line as mixed OHL / UGC.	The study concludes: Part 1: Identified a potential for the occurrence of 'severe' Temporary Overvoltages (TOVs) which would exceed the withstand capability of the installed equipment. The Study concludes that the magnitude of these TOVs is such that there are no technical solutions currently available to mitigate this risk and the only option available would be to use operational counter measures. Part 2: To achieve the required 1,500 MW capacity, the optimum UGC solution is a 400 kV double circuit 1,400mm^2 aluminium cable - requiring a total of 2,600MVArs (1,300MVArs per circuit) of reactive compensation would be required at the proposed terminal points and an additional reactive compensation installation approximately half-way between Turleenan and Moyhill (Kingscourt). Part 3: No significant TOVs were identified for the mixed OHL / UGC. However, further detailed studies relating to the particular positions and lengths of cable sections in order to determine the measures that may be taken to ensure safety and stability from the overall circuit would be necessary.
The TransGrid Study - *Investigating the Impact of HVDC Scheme in the Irish Transmission Network* Prepared by TransGrid solutions Inc. of Canada **October 2009**	The study involved a technical comparison of HVAC OHL versus HVDC UGC and one section dealt in particular with the proposed Meath-Tyrone 400 kV Interconnection Development.	There are no working examples in the world of a multi-terminal HVDC scheme, embedded in a meshed AC network as would be required for the proposed Meath-Tyrone Interconnection Development. Such a scheme is however in theory at least, technically feasible (*Correct at the time of writing in 2009*). Having carried out a technical comparison of HVDC versus HVAC technology for this proposed interconnector it was found that there are no significant reasons to select HVDC over HVAC. The AC option showed significantly lower loses, fewer overloads in the Louth / Tandragee / Turleenan area, a stronger system at the Moyle Interconnector terminal and a less complex control and protection scheme. Embedding a HVDC circuit in a meshed AC network "*can impose an added complexity to future network planning and expansion. For instance when planning the system it is difficult and expensive to tap into an existing HVDC circuit whereas an AC circuit can be easily tapped to serve new load or build a new AC station and lines."* A technical comparison of the two technologies (HVAC and HVDC) concluded that, for the scenarios and contingencies studied, there were no significant technical advantages identified for the use of a HVDC circuit in place of the HVAC circuit proposed.

Report Title	Context of Report	Main Findings / Observations of Report
The PB Power Technology and Cost Update - *Comparison of High Voltage Transmission Options: Alternating Current Overhead and Underground and Direct Current Underground* [This is an addendum to the 2009 PB Power Study and should be read in conjunction with that 2009 report] **April 2013**	EirGrid and NIE requested PB Power to update their 2009 report to take account of scientific advances in the development of new, feasible transmission technologies, and also to review the cost estimates for practical transmission configurations. The updated PB Power Report does not revisit the landscape aspects and most of the technical aspects as these remain unchanged. The *PB Power Electricity Transmission Costing Study* published in 2012 by the UK Department of Energy and Climate was used as a source of information for the technology and cost update.	The most cost effective solution for the proposed scheme would be a 400 kV AC OHL, estimated to cost around €165 million[82] to construct A 400 kV AC UGC is estimated to cost €935 million[83], or over 5.7 times as much as an equivalent OHL to construct, and would also cost significantly more than an OHL to operate and maintain over its lifetime. A HVDC UGC is estimated to cost €1,005 million[84], or 6 times as much as an equivalent 400 kV AC OHL to construct, and twice as much as an OHL to operate and maintain over its lifetime.

[82] Based on the exchange rate in March 2015: £120 million

[83] Based on the exchange rate in March 2015: £678 million

[84] Based on the exchange rate in March 2015: £729 million

Report Title	Context of Report	Main Findings / Observations of Report
The PB Power Technology and Cost Update – Cavan-Tyrone & Meath-Cavan 400 kV Transmission Circuits Technology and costs Update**.** *Supplementary Note to the April 2013 Addendum* **July 2013**	In April 2013 EirGrid published its *Final Re-evaluation Report* and at the same time announced its decision to defer the previously proposed intermediate substation near Kingscourt, Co. Cavan. A consequence of the deferment of this substation, regardless of which technology option is chosen, is that it would reduce the initial investment required to develop the interconnector so EirGrid requested PB to provide, in a supplementary note, an indication of the impact of the deferment on the initial investment.	The most cost effective technology option remains a 400 kV AC OHL, estimated to cost around €140 million[85]. With the deferment of Kingscourt, 400 kV AC UGC becomes the most costly option, estimated at around €880 million[86], or €740 million[87] more than the equivalent AC OHL. The deferment of Kingscourt has little or no impact on the cost differential with the AC OHL as similar costs are deferred in the case of both options (*Correct at time of writing in 2013*). The deferment of the substation near Kingscourt will however have a significant impact on the initial investment required to develop the HVDC option. This is due to the very high cost of HVDC converters, and the fact that, with the deferment, converters would only be required initially at Turleenan and Woodland not Kingscourt. Under this scenario, the HVDC option, at an estimated cost of around €810 million[88], is no longer the most costly option. It is still, however, €670 million[89] more costly than the least cost option, the 400 kV AC OHL. The initial investment cost of the HVDC option is reduced, due to the deferment of the substation near Kingscourt, by around €160 million[90] (€970M - €810M[91]), whilst the initial investment costs of the two AC options are only reduced by around €20 - €25 million[92]. The disparity of the effects on the AC and HVDC options highlights one major disadvantage of the HVDC option for the Ireland N-S Link. This is that, if the N-S Link is developed using HVDC technology, future 'tap-ins' to the circuit for the substation near Kingscourt and / or for some other (as yet unknown) requirement at some other location along the route, will be many times more expensive than tapping into an AC circuit.

[85] Based on the exchange rate in March 2015: £102 million

[86] Based on the exchange rate in March 2015: £638 million

[87] Based on the exchange rate in March 2015: £537 million

[88] Based on the exchange rate in March 2015: £587 million

[89] Based on the exchange rate in March 2015: £486 million

[90] Based on the exchange rate in March 2015: £116 million

[91] Based on the exchange rate in March 2015:£703 million - £587 million

[92] Based on the exchange rate in March 2014: £15 - £18 million

10.2.6 Further Specific Technical Studies and Reports of Direct Relevance to the Proposed Interconnector

32. There are two other technical studies of relevance, which were specifically focused on the proposed interconnector. These are:

- The Ecofys Study (Department of Communications, Energy and Natural Resources (DCENR) 2008). A Study on the Comparative Merits of Overhead Electricity Transmission Lines Versus Underground Cables, carried out by Ecofys on behalf of the Department of Communications, Energy and Natural Resources.
- The International Expert Commission (IEC) Report (2012). A review of the case for, and cost of, undergrounding all or part of the Meath–Tyrone 400 kV line.

33. The objectives of these studies, and the conclusions set out in each of the associated reports, are described in further detail in Table 10.2.

Table 10.2: Other Reports Prepared on Alternative Transmission Technologies

Report Title	Context of Report	Main Findings / Observations of Report
The Ecofys Study - *Study on the Comparative Merits of Overhead Electricity Transmission Lines versus Underground Cables* Prepared by Department of Communications, Energy and Natural Resources (DCENR) **May 2008**	The aim of the study was to provide the best available professional advice on the relative merits of constructing and operating OHL compared to UGC, having regard to technical characteristics, reliability, operation and maintenance factors, environmental impact, possible health issues, and cost.	Globally the vast majority (approximately 99.5%) of UGC is generally used in areas of high population density or high land values – generally urban areas - where it is difficult to find suitable OHL routes. International experience shows that extra high voltage (EHV) UGC is generally not used for any great distance, e.g. the longest such UGC is in Tokyo and is only 40km in length. Whilst decisions may be taken to underground lower voltage networks of distribution systems, this is not normally applied to the higher voltage networks of transmission systems, as the technology involved is substantially different and more demanding. Both EHV UGC and OHL are found to have an environmental impact but these impacts are different for the different technologies, and in most cases mitigation measures are available, e.g. UGC has a greater impact on water resources and soils and geology, whereas OHL has a greater impact on Landscape and Visual and Communities. The study distinguishes between the perceived health risks associated with Electro-Magnetic Fields (EMF) and actual health risks associated with EMF and cites the International Commission of Non-Ionising Radiation Protection (ICNIRP) recommendation. The study concludes that the construction and operation of an EHV UGC in Ireland with a length of 100km would not be backed by worldwide experience. Mitigation measures are proposed to reduce the potential impact of the planned Interconnector on the environment.
The IEC Report - *Meath-Tyrone Report Review by the International Expert Commission* August – November 2011. *(A review of the case for, and cost of undergrounding all or part of the Meath-Tyrone 400 kV Interconnection Development.)* Prepared by Normak B., et al. **November 2011**	In July 2011 the Minister for Communications, Energy and Natural Resources appointed the IEC to:- Examine the case for, and cost of, undergrounding all or part of the Meath–Tyrone 400 kV line (now known as the North-South 400 kV Interconnection Development – the subject of this instant application); Review expert literature already available both in Ireland and internationally in relation to undergrounding high voltage [HV] power lines; Consider the route or routes proposed by EirGrid; and Consult with EirGrid, the North East Pylon Pressure Committee and the County Monaghan Anti-Pylon Committee, and other bodies / organisations.	The main findings of the report are as follows:- Based on an analysis of a number of different high capacity transmission projects in Europe, it is clear "*that there is no single "right" solution. Each project must be judged on its own merits and hybrid solutions, i.e. combining different technologies, have been applied in many cases, for instance partially undergrounding a link. A specific technical solution must be derived accounting for local conditions*"; There have been advances in transmission technology in recent years, examples being "*the development of VSC HVDC technology and its deployment in transmission projects and the introduction of new tower designs for overhead lines*"; The only recommendation the IEC made was "*against fully undergrounding using an AC cable solution*"; While the report does not recommend that the interconnector be undergrounded it does find that if the interconnector has to be undergrounded for all, or a significant portion, of its length then with today's technology the best solution would be "*a VSC HVDC solution combined with XLPE cables*"; and The report concludes that a high voltage AC OHL solution for the proposed interconnector still offers "*significantly lower investment costs than any underground alternative and could also be made more attractive by investing slightly more in new tower designs than the classical steel lattice towers now proposed".*

10.2.7 Other Third Party Reports

34. There are a number of other studies which are also referred to in this chapter. These are:

- Denmark's Strategy for the Development of its 400 kV Network[93] – (Technical Report on the Future Expansion and Undergrounding of the Electricity Transmission Grid –: Summary – April 2008 and the Cable Action Plan: 132-150 kV Grids – March 2009). The first report considers the long term strategy for the development of the electricity transmission network in Denmark. Six 'Expansion Principles' were considered. These ranged from 'Expansion Principle A - complete undergrounding' to 'Expansion Principle F - no further expansion of the grid'. Subsequently the mid-range strategy known as 'Expansion Principle C' was adopted. The second report, the Cable Action Plan outlines how and over what period this strategy will be implemented.
- Askon Report[94] (Study on the Comparative Merits of Overhead Lines and Underground Cables as 400 kV Transmission Lines for the North-South Interconnector Project (2008) commissioned by North East Pylon Pressure (NEPP)).
- Cigré Technical Brochure 379[95] - Update of Service Experience of HV Underground and Submarine Cable Systems, ISBN 978 -2-85873-066-7 (April 2009). The study collected and analysed data relating to the installed quantities of underground and submarine cable systems rated at 60 kV and above together with the service experience and the performance of existing underground and submarine cable systems.
- UK Electricity Transmission Costing Study (2012)[96]. This study was performed on behalf of the UK Department of Climate Change (DECC) with the purpose of informing the Infrastructure Planning Commission (IPC) in regard to the costs of feasible transmission options.

[93] Available at www.Energinet.dk. Available at www.Energinet.dk.

[94] This report is not publically available but can be obtained from NEPP, refer to www.nepp.ie for further information.

[95] The technical brochure is available from Cigré. Cigré is an acronym in the French language for 'The International Council on Large Electric Systems'.

[96] Available at http://www.theiet.org/factfiles/transmission-report.cfm.

Table 10.3 Reports Prepared by EirGrid on Technology Updates

Report Title	Context of Report	Main Findings / Observations of Report in Respect of the Different Technologies
North-South 400 kV Interconnection Development Preliminary Re-evaluation Report *(PRR)*, EirGrid **May 2011**	This report comprises a comprehensive re-evaluation of EirGrid's previous application to An Bord Pleanála for approval of the Meath-Tyrone 400 kV Interconnection Development, being that portion of the proposed interconnector occurring within Ireland. It includes review and consideration of the approximately 950 submissions to An Bord Pleanála in respect of that previous application and the statements presented at the associated oral hearing of 2010.	Having reviewed all the technology options the report concludes that: HVDC technology and HVAC undersea cable do not comply with the project objectives / design criteria for the proposed interconnector. There have not been any developments in transmission technology which would alter EirGrid's opinion that the use of long HVAC cables on the Irish transmission system is not feasible within the constraints of EirGrid's statutory obligations. No new information has come to EirGrid's attention which would alter its opinion that a 400 kV AC OHL is the best technical solution for this development. Partial undergrounding using 400 kV AC technology may be feasible, but only if the length to be installed is relatively short.
North-South 400 kV Interconnection Development Final Re-evaluation Report *(FRR)* EirGrid **April, 2013**	The FRR represents the culmination of a detailed re-evaluation process, undertaken by EirGrid and its consultants, of all aspects of the proposed interconnector. It includes consideration of the feedback received during the public consultation in respect of the PRR. It also considered documents issued since the publication of the PRR, which are relevant to the overall re-evaluation process including the IEC Report. It provides an update on reliability statistics for high voltage AC UGC and OHL, and updates on the world's longest high voltage AC XLPE cable circuits and the cost comparison between 400 kV AC UGC and AC OHL. It includes an Appendix setting out the review and consideration of the approximately 950 submissions to An Bord Pleanála in respect of that previous application and the statements presented at the associated oral hearing of 2010.	Having reviewed all the technology options the report concludes that: The DC option, even one using the latest VSC HVDC technology, is not acceptable for the proposed interconnector as it would be too costly and (for this specific application) would not operate as effectively as a standard 400 kV AC OHL. An entirely underground 400 kV AC option is not an acceptable solution. There have not been any developments in transmission technology which would alter EirGrid's opinion that the use of long HVAC cables (that is greater than approximately 10km in length) on the Irish transmission system is not feasible. A 400 kV AC OHL is the best technical solution for this development and would be significantly less costly than any UGC alternative. Partial undergrounding using 400 kV AC UGC will be considered, but only if the length of UGC to be installed is relatively short (less than approximately 10km in one continuous length or an accumulation of shorter lengths). The emerging preferred support structure for use on the proposed 400 kV OHL development is the lattice steel structure known as the 'IVI' tower. However, EirGrid will further consider alternative structures, including consideration of any feedback on the matter received during the public engagement in respect of the FRR, before finalising the preferred project solution.
North-South 400 kV Interconnection Development Preferred Project Solution Report (PPSR) EirGrid **July 2013**	The PPSR provides detail on the preferred line design for the proposed interconnector. It considers and includes responses to the feedback received during the public engagement in respect of the FRR. It includes the identification of feasible locations for, and design of, the planned transmission line infrastructure, such as tower positions, tower types and associated construction related details (e.g. indicative access tracks). It includes reference to EirGrid's consideration of tower designs and the basis for confirmation of the IVI tower as the preferred support structure for the development.	This report outlines the background to the identification of the preferred line design of the proposed interconnector. It explains how the process generally involves consideration of a range of environmental and technical matters relevant to OHL design and how other considerations specific to the particular development (including feedback from stakeholders and landowners) have fed into the process. It identifies feasible locations for, and design of, the planned transmission line infrastructure, such as tower positions, tower types and associated construction related details (e.g. indicative access tracks).

10.2.8 Review of Transmission Technology Alternatives Considered for the proposed interconnector

10.2.8.1 Overview

35. There are several technological alternatives by which a transmission circuit of the capacity required for the proposed interconnector could, in theory, be implemented. Some of these alternatives utilise AC technology while others utilise DC technology.

36. Until relatively recently, DC technology was only used for high capacity electricity transmission in circumstances where it was the only technically feasible or cost effective option. In recent times, however, during consultations associated with transmission projects (including in the case of this proposed interconnector) stakeholders have suggested that DC technology should be used not because of any technical, operational or cost advantage that might accrue but rather because it is seen as a way of facilitating the undergrounding of the proposed interconnector.

10.2.8.2 High Voltage Direct Current (HVDC) as an Alternative to High Voltage Alternating Current (HVAC)

37. The first step in the in-depth consideration of the technological alternatives that are potentially feasible for this development is to carry out a general evaluation of HVDC technology, as an alternative to the standard HVAC technology regardless of whether the scheme is to be implemented using OHL, UGC or a combination of both.

38. The existing electricity transmission system in Ireland is, as in every other country in the world, a HVAC (or AC) system. Any new transmission project that utilises HVAC would therefore be an extension of the existing technology.

39. HVDC is an alternative method of transmitting electricity. HVDC technology is mostly used to transmit bulk power from one point to another over long distances where HVAC is not technically and / or environmentally acceptable (e.g. a long (> 50 km) high capacity submarine cable).

40. HVDC can also be the most effective option for very long transmission circuits. Plate 10.2 illustrates graphically how the cost differential of HVDC UGC, HVDC OHL, HVAC UGC and HVAC OHL varies with circuit length. The HVDC options start at a cost disadvantage to any HVAC option due to the relatively high cost of the converter stations at the terminals however as the circuit length increases the difference in cost declines until eventually a breakeven point is reached and thereafter the HVDC option becomes the most effective. For example in the graph below the cost breakeven point for the HVDC UGC option versus the HVAC OHL option occurs when the circuit length is in the region of 600-800km whereas in the case of the HVDC UGC option the breakeven point with HVAC UGC is in the region of 80–120 km. On the graph the curve representing the HVDC UGC option (dashed purple) and the curve representing the HVAC OHL option (light blue) do not intersect within the 0 to 1,000 km range thus indicating that under these circumstances a HVDC UGC would never be more cost effective than a HVAC OHL option. In addition the graph would suggest that the breakeven or crossover point between these options would occur at some circuit length far in excess of 1,000 km, a distance that is of no relevance for a country the size of Ireland.

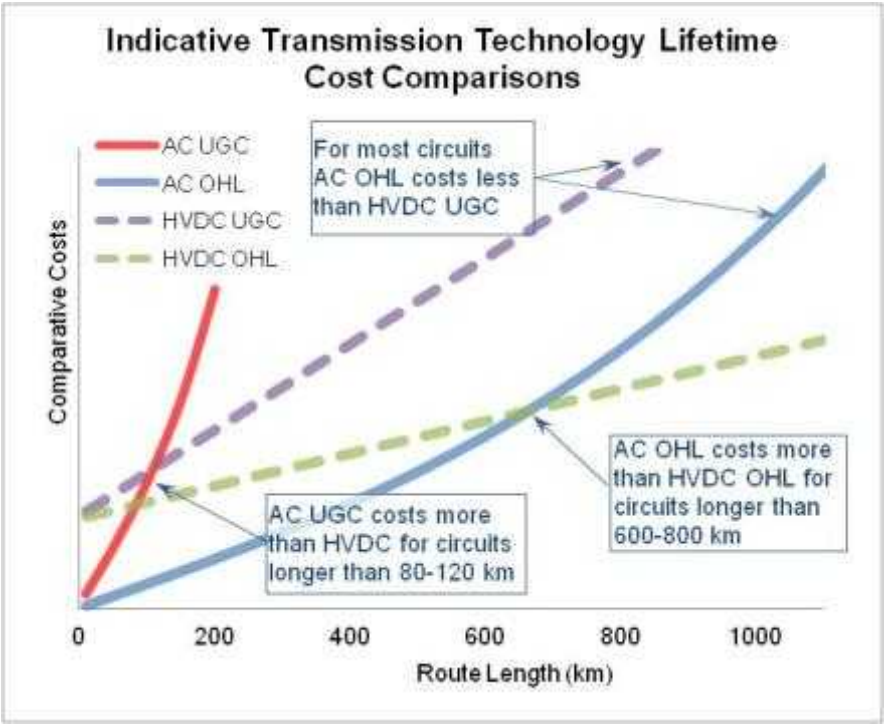

Plate 10.2: Comparison of HV Transmission Options – Cost versus Circuit Length

(Source: Parsons Brinckerhoff, incl. Electricity Transmission Costing Study 2012)

41. HVDC is also used for linking independently operated (synchronous) HVAC systems (e.g. an interconnector such as the Moyle Interconnector) where it is impossible to link such systems using a standard HVAC circuit.

42. Inserting a HVDC circuit between any two points in a HVAC network would require the HVAC electricity to be converted into HVDC electricity at one end, transmitted through cable or OHL to the other end, where it would be converted back from DC to AC, and then transmitted back into the HVAC network. This is inefficient (unless the HVDC circuit is very long) and costly (in terms of the requirement for converter stations) but it is technically feasible.

43. There are two main HVDC convertor station technologies – Current Source Convertors (CSC) also known as Line Commutated Converters (LCC) and the emerging Voltage Source Converters (VSC). Both can be applied in combination with OHL and UGC.

44. VSC DC is considered a more flexible technology than LCC DC as it can be less difficult to integrate into an AC grid. This VSC DC technology continues to develop with converter stations becoming more efficient, reliable and compact; these advances were specifically referred to in the findings of the IEC Report.

45. In response to the IEC Report, there was a review of the comparative assessment of an UGC VSC HVDC circuit[97] versus a standard high voltage OHL AC circuit for the implementation of the proposed interconnector against the previously identified project objectives / design criteria. The findings are as follows:-

[97] The IEC disregarded DC OHL in its report (page 18) on the basis that the cost of a DC OHL option would be similar to a DC UGC option if the cables were to be installed under optimum conditions (as described in point c below). While this is debatable it can be said that from a technical and operational perspective there is no difference between DC OHL and DC UGC other than the fact that the time required to repair a fault on a DC UGC would be considerably longer (many weeks longer) than that required to repair a fault on a DC OHL.

a) Comply with all relevant safety standards;

46. Both options are equally compliant. In the case of this criterion no difference in the two technology options is observed.

b) Comply with all system reliability and security standards;

47. The proposed interconnector as part of the 400 kV network will form a necessary extension of the backbone of the 'all-island' transmission network, and is required in order to enable the two networks, north and south, to operate as if they were one network. It will be an integral part of the 'all-island' meshed network, and as such the power flow (quantity and direction) in the circuit may be required to react instantaneously to dynamic system changes such as rises and falls in system demand, and sudden and unplanned changes in system configuration due to unplanned outages of other circuits or generators. If the proposed interconnector is a standard AC circuit then the power flow will react naturally and instantaneously, without any input from a control system or human operator, to such dynamic changes to the system.

48. The power flow on a DC circuit on the other hand will not react naturally to such changes. The DC circuit will only react if prompted to do so by a controller. However, a human operator would not be able to react quickly enough, so the control would have to be by means of a computerised control system. Such a control system would be bespoke and very complex, and would therefore introduce the very real risk of mal-operation. Analysis of the risk of mal-operation of the computerised system controlling the operation of a HVDC north-south interconnector has shown that this could (due to its relatively high capacity and strategic location within the network) result in the collapse of the entire 'all-island' electricity system. Taking such a risk is unnecessary when there is a technically superior (for this type of application) and less risky option readily available. Therefore it is SONI's opinion that under the heading of 'comply with all system reliability and security standards', a standard AC circuit is preferable to a DC circuit for the specific characteristics of the proposed interconnector.

c) Provide an environmentally acceptable and cost effective solution;

49. Both the DC UGC option and the AC OHL option can be installed in such a way as to be environmentally acceptable. It is the cost difference therefore which will be the deciding factor in the case of this criterion.

50. The IEC estimated that the standard AC OHL circuit would cost €167 million[98] whereas the DC UGC alternative would cost €500 million[99]. That is a difference of €333 million[100]. The PB Power Technology and Costs Update Report (July 2013)[101], on the other hand, found that the standard AC OHL circuit would cost €140 million[102] whereas the DC UGC alternative would cost €810 million[103]. That is a difference of €670 million[104].

51. This significant variation between the cost estimates in the IEC Report and the PB Power Update Report for the DC alternative can be explained as follows. Both reports agree that the converter stations will cost approximately €300 million[105] (that is €150 million[106] each). The cost difference arises in the difference in cost per km for the DC UGC connecting between the two converter stations.

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[98] Based on the exchange rate in March 2015: £121 million

[99] Based on the exchange rate in March 2015: £363 million

[100] Based on the exchange rate in March 2015: £241 million

[101] The Supplementary Note of July 2013 to the PB Power Technology and Costs Update Report of April 2013 revise the comparative cost estimates by excluding any provision for the intermediate substation near Kingscourt (refer to summary details of report in Table 4.2). This results in the PB estimates being directly comparable with those of the IEC as the IEC also excluded any provision for the intermediate substation.

[102] Based on the exchange rate in March 2015: £102 million

[103] Based on the exchange rate in March 2015: £587 million

[104] Based on the exchange rate in March 2015: £486 million

[105] Based on the exchange in March 2015: £218 million

52. The IEC assumes optimum conditions are available for the installation of the DC cables. By 'optimum conditions' they mean that the cables will be installed in the wide soft margin of a major road for almost the entire length and that the cables will be installed side by side in a single 3 metre wide trench (Plates 10.3 and 10.4 are extracted from the IEC Report and were included in that report for the purpose of illustrating the assumptions that formed the basis for the UGC cost estimate). This results in a cost per km of €1.36 million[107] for 140km[108] giving a total cable cost of €190 million[109].

Plate 10.3: Wide Soft Margin of a Major Road

(Source: IEC Report p. 46)

[106] Based on the exchange in March 2015: £109 million

[107] Based on the exchange rate in March 2015 : £0.99 million

[108] The IEC assumed that the route for UGC would be 140km in length whereas PB Power identified a route for UGC and measured it at 135km in length.

[109] Based on the exchange rate in March 2015: £138 million

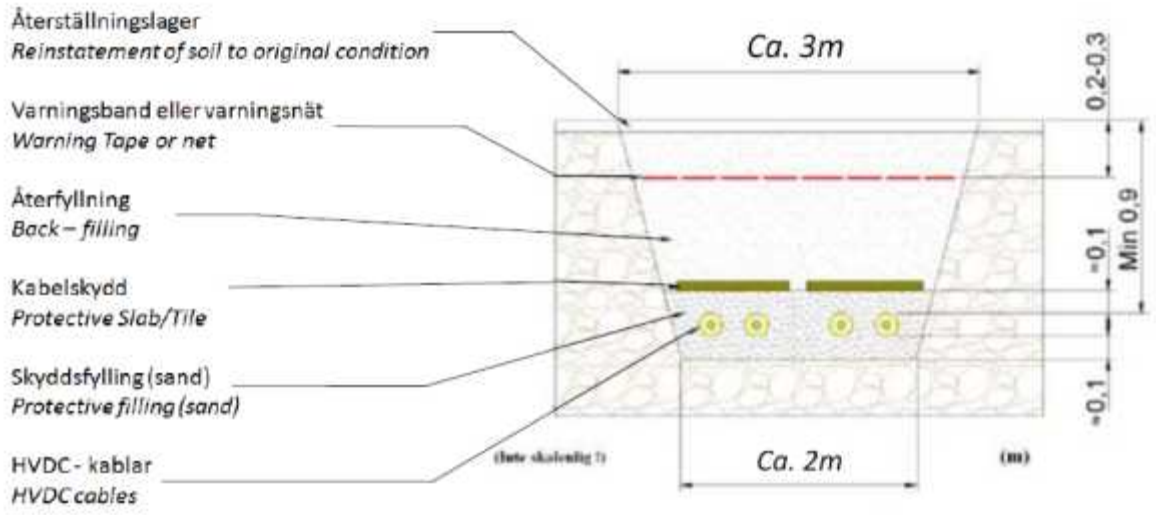

Plate 10.4:Section through cable trench for two parallel HVDC circuits

(Source: IEC Report (p. 46) with translation to English by EirGrid)

53. The PB Power estimate is based on the assumption that the DC cables will be installed along a route across country through farmland in the corridor identified in the PB Power Report of 2009. This results in a cost per km of €3.76 million[110] for 135km giving a total cable cost of €508 million[111].

54. In SONI's view, the IEC estimate is understated. A long major road, with a wide soft margin, linking Batterstown in County Meath to Turleenan in County Tyrone does not exist. Instead the roads in the five counties to be traversed are generally narrow and winding. The IEC itself recognises that installing cables under such roads would result in a higher cost per km than the €1.36 million[112] previously indicated. It is also the case that due to the winding nature of the roads that any route that follows the public roads will be longer than a more direct cross country route.

55. In their consideration of the DC option, the respective applicants follow the costing approach adopted by PB Power for the following reasons:

- It will allow the two pairs of DC cables that would be required for such a scheme to be installed in two separate trenches that are sufficiently far apart (> 5 metres) that it reduces the likelihood, to a level that can be considered to be negligible, of a single event causing damage to both sets of cables at the same time. This will result in a significantly better level of service availability and as a result improved security of supply.
- It will result in a shorter more direct route.
- It will avoid extensive road closures and the considerable disruption to local communities that that entails.

56. Installing cables along a cross country route would likely however result in a greater environmental impact than that of any option that involves their installation under or adjacent to public roads.

[110] Based on the exchange rate in March 2015: £2.72 million

[111] Based on the exchange rate in March 2015: £368 million

[112] Based on the exchange rate in March 2015: £0.99 million

57. However no matter which approach is assumed for routing the DC UGC, across country or under public roads, the cost difference between the proposed AC OHL and the DC technology options is so great that it renders the HVDC UGC option unacceptable under this criterion.

58. While not the only reason the excessive cost of the HVDC technology is, on its own, sufficient reason for SONI to discount it as an option for the implementation of the proposed interconnector. In this regard, Regulation 8(3) obliges the TSO, when discharging its functions to take into account the objective of minimising overall costs of the generation, transmission, distribution and supply of electricity to final customers.

d) Have a power carrying capacity in the region of 1,500 MW, and connect between appropriately robust points on the transmission networks north and south of the border;

59. Both technology options are equal under this criterion.

e) Facilitate reinforcement of the local transmission network in the north-east area of the Republic of Ireland;

60. Both technology options are equal under this criterion. Although the need to reinforce the north-east area for security of supply reasons is no longer an immediate driver of the delivery of the proposed interconnector (as that reinforcement is not now expected to be required for at least a decade), the early presence of the interconnector will nevertheless provide reinforcement to the area by increasing interconnection between Ireland and Northern Ireland. Based on current predictions, such reinforcement will provide sufficient additional transmission capacity in the area to cater for growth in electricity consumption for many years (assuming median growth rates) and will also put the north-east area in a good position if an even stronger economic recovery should emerge in the coming years.

f) Facilitate future grid connections and reinforcements;

61. All circuits forming a meshed transmission network have the potential to be 'tapped' into at an intermediate point to provide a new grid connection or reinforcement sometime in the future. It is envisaged by EirGrid that the circuit that forms the proposed interconnector will require an intermediate substation in the vicinity of Kingscourt at some future point in time (although not now expected to be required for at least a decade), and others (where and when they will be required cannot be predicted at this juncture) are probable. The facilitation of future grid connections and reinforcements is therefore an important consideration of the technology choice.

62. As stated previously, a DC circuit does not naturally integrate within an AC network and a consequence of this is that a DC circuit embedded in an AC network would not facilitate future grid connections and reinforcements. If the north-south interconnector were to be developed using HVDC technology, then the cost of the planned 'tap in' to the circuit near Kingscourt, based on the estimates of the IEC, would be in of the region of €150 million[113] more than the cost of tapping into an equivalent AC circuit. This would in all likelihood make the plan ultimately to reinforce the north-east area of the Republic of Ireland by developing a new substation near Kingscourt uneconomic. Consequently that reinforcement would have to be achieved by some other means, such as the building of new AC transmission lines into the area.

63. In addition to the excessive cost of tapping into a DC circuit, the only practical way of tapping into such a circuit would result in the creation of a 'multi-terminal' DC circuit (i.e. a DC circuit with more than two terminals). A multi-terminal DC circuit would require an even more complex control system than a two terminal circuit, thus increasing the already unacceptable risk of mal-operation.

64. The poor facilitation of future grid connections and reinforcements presented by the DC option makes the use of HVDC technology less preferred than a standard AC circuit when compared against this criterion for the implementation of the proposed interconnector.

[113] Based on the exchange rate in March 2015: £109 million

g) Comply with good utility practice.

65. There are no working examples in the world[114] of a DC circuit embedded in a small and isolated AC transmission network, such as that on the island of Ireland. The examples of planned DC interconnectors in Europe that were identified in the IEC Report (that is the proposed France-Spain Interconnector and the proposed Norway–Sweden Interconnector) are not comparable with the proposed interconnector. The electricity networks in those four countries are much larger (six times larger in the case of Norway-Sweden and almost 20 times larger in the case of France-Spain) and stronger than those on the island of Ireland and they already have multiple AC interconnections with each other.

66. The risk of failure, and the consequence of failure, is an important factor in deciding whether the embedding of a DC circuit in an interconnected network is, or is not, good practice. There is currently only one interconnector between Ireland and Northern Ireland and these two networks are required to merge into each other and to operate as if they were one network. The proposed interconnector, with a power carrying capacity of 1,500 MW, will become the 'backbone' of this 'all-island' network.

67. By contrast the proposed France / Spain and Norway / Sweden DC Interconnectors are upgrades in cross border power transfer capacity between networks that are already highly interconnected[115] with each other. Also unlike the network on the island of Ireland the Norway / Sweden and France / Spain networks form part of a wider continental network and have multiple interconnections (both synchronous and non-synchronous) with other third party countries. In addition Table 10.4 illustrates that the power carrying capacity of the proposed north south interconnector relative to the combined 'all-island' system demand is far greater than the comparable figure in the case of the proposed France / Spain and Norway / Sweden Interconnectors. The North South Interconnector would have the capacity to carry 23.8% of the 'all-island' peak demand whereas the comparable figures for the France / Spain and Norway / Sweden Interconnectors are 2.9% and 1.4% respectively and that this in turn results in the proposed interconnector (i.e. between NI and ROI) having a far greater level of strategic importance than those other proposed interconnectors.

[114] There are a few working examples in the world (December 2013) of a DC circuit embedded in an AC transmission network however these networks are not representative of the small and isolated AC transmission network on the island of Ireland. The closest comparable scheme is probably the 1,400MW Kii Channel project in Japan which uses OHL and submarine cable. Although an island network, Japan represents a much larger generation and load base than Ireland.

[115] There are five existing AC transmission interconnectors between Norway / Sweden, four between France / Spain and one between Ireland / Northern Ireland.

Table 10.4: Comparison of Interconnected Networks and the Relative Importance of Proposed Interconnectors

Interconnected Countries	Power Carrying Capacity of Proposed Interconnectors	Combined System Peak Demand[116]	Capacity of Proposed Interconnectors as a % of Peak Demand
Ireland - Northern Ireland	1,500 MW	6,311 MW	23.8%
Norway - Sweden	2 X 720 MW	49,643 MW	2.9%
France - Spain	2 X 1,000 MW	145,625 MW	1.4%

68. The capacity of the proposed North-South Interconnector relative to the 'all-island' system peak demand together with the relatively limited level of interconnection with each other and with third party networks means that the North-South Interconnector will have a far greater level of strategic importance to Ireland

69. The strategic importance of the proposed new France /Spain and Norway / Sweden DC interconnectors will be far less critical to the overall system security of their combined networks than the proposed north south interconnector will be to the 'all-island' network. These proposed DC interconnectors are therefore not representative of a DC circuit embedded in a small and isolated AC transmission network, such as that on the island of Ireland.

70. It is on this basis that implementing the proposed interconnector using HVDC technology would not be considered as complying with 'good utility practice' or complying with 'good international practice'.

71. The re-evaluation of the HVDC VSC (OHL or UGC) option and the standard AC OHL option which included regard for the findings of the IEC report is outlined above (i.e. points a to g) and a summary of same is shown in Table 10.5. The overall conclusion is that the DC option is least preferred, primarily on the basis of cost effectiveness, its poor ability to facilitate future grid connections and because it would not be considered as complying with 'best international practice'.

[116] The annual instantaneous peak loads were obtained from the ENTSO-E website. The instantaneous peak loads for the respective pairs of networks did not occur at the same time (although they were within days of each other). The combined figures are therefore a slight over statement of the actual combined instantaneous system peak demand.

Table 10.5: Overview AC versus DC - Strategic Constraints of Potential AC and DC Transmission Alternatives

Points	Description	AC OHL	DC (UGC or OHL)
	Comply with SONI's Statutory and Regulatory Obligations		
a)	Safety	***	***
b)	Reliability and security	***	**
c)	Cost effectiveness	***	*
	Due regard to the environment	**	**
	Meet the Specific Needs of the Project		
d)	1,500 MW capacity and appropriately strong points of interconnection	***	***
e)	Reinforce the North-East transmission network	***	***
	Meet the General Objectives for All Projects of this Type		
f)	Facilitate future grid connections and reinforcements	***	*
g)	Good Technical Solution – Be 'best international practice' with proven technology	***	*

***	Preferred, limited impact, acceptable
**	Some impact, some difficulty
*	Least preferred, major impact, unacceptable

10.2.8.3 HVDC Offshore Submarine Cabled Alternative

72. During public consultation some stakeholders suggested that consideration be given to an offshore cable that is a submarine cable off the east coast, for linking the two transmission networks on the island of Ireland. This suggestion was made without specifying whether the submarine cable would utilise AC or DC technology. The DC submarine option is considered here while the AC submarine option is considered later in this chapter.

73. There are numerous examples of long high capacity DC submarine cables in Europe so this alternative is potentially feasible. However, all of the disadvantages of the 'on-land' DC option vis-a-vis a standard AC transmission technology option identified above apply in the case of the sub-sea DC option. In addition to those disadvantages the following also applies.

74. For any on-land UGC option there is a concern about the relatively long time it takes to find and repair faults. In the case of the undersea options the time to repair will be significantly greater than for the equivalent on land option. Reference can be made to the example of the six months that it took to

repair a fault on the NorNed[117] HVDC cable during commissioning in 2007 / 2008. Much of the delay was due to poor weather conditions during the winter months and the resulting concerns for health and safety of repair crews. For this reason a DC submarine cable off the east coast, is considered to be even less preferred when rated against the criteria of 'Reliability and Security' than an on-land DC cable to meet the specific need for, and parameters of, the proposed interconnector.

75. The circuits required for the proposed interconnector must connect into the existing transmission grid at appropriately strong points north and south of the border. In the case of the undersea option long on land cables are required to reach the coast (in excess of 40km from Woodland to the coast). An entirely on land cabled option can take a more direct cross country route and as a result be considerably shorter and by implication less expensive than its undersea equivalent. For this reason a DC submarine cable, is considered to be even less preferred when rated against the criteria of 'Cost Effectiveness' than an on-land DC cable.

76. SONI's overall conclusion on the HVDC offshore submarine alternative is that it is not acceptable for this development and merits no further consideration.

10.2.8.4 Overall Conclusion on High Voltage Direct Current (HVDC) as an Alternative to High Voltage Alternating Current (HVAC)

77. The respective applicants have considered the option of using HVDC technology for implementing the proposed interconnector. This consideration is supported by the findings of the PB Power Study (2009, April 2013 and July 2013) and the TransGrid Study (see summary in Table 10.1). In addition consideration has been given to the findings of the International Expert Commission (see summary of IEC Report in Table 10.2).

78. The overall consideration found that any DC option whether implemented using UGC, OHL or off-shore submarine cable would not facilitate the future development of the transmission network as well as any AC option. Nor would the DC option be considered as complying with 'best international practice'.

79. While the cost of the DC options (UGC or OHL) would be comparable with an AC UGC option they would all be significantly more expensive to implement than the proposed 400 kV AC OHL option, €670 million[118] more according to the findings of the PB Power Technology and Cost Update (July 2013) and €333 million[119] according to the findings of the IEC Report.

80. In addition the proposed interconnector is required to be an integral part of the 'all-island' AC transmission network and will therefore be required to operate like any other AC circuit within the network. It is possible, in theory at least, to embed a DC circuit into an AC transmission network and make it operate like an AC circuit however this would require a complex and be-spoke control system. The risk of failure, and the consequence of failure, must be a factor in the consideration of any technical alternative. Introducing a complex and be-spoke control system into the operation of a strategically important part of the 'all-island' transmission network brings with it considerable risk for system security and stability. Such risk taking is unnecessary in the case of this proposed interconnector as there is a technically superior and less risky option readily available.

81. As a result of all of the foregoing it was concluded that any option using HVDC technology is not an appropriate or acceptable option for implementing the proposed interconnector.

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[117] NorNed is a HVDC undersea interconnector between Norway and the Netherlands. It was first put into service in May 2008.

[118] Based on the exchange rate in March 2015: £486 million

[119] Based on the exchange rate in March 2015: £241 million

10.2.9 Consideration of High Voltage Alternating Current (HVAC) Options

10.2.9.1 Overview

82. The use of HVDC technology whether implemented by OHL or UGC, on-land or offshore, has been discounted above. All further consideration and comparison of OHL and UGC is therefore restricted to HVAC technology particularly at the 380 kV / 400 kV level.

10.2.9.2 High Voltage AC Overhead Line (OHL)

83. Over 98% of the on land Extra High Voltage (EHV - 315 kV to 500 kV) electricity transmission network in Europe is of HVAC OHL construction. For comparative purposes the extent of the 380 kV / 400 kV network in ten Western European countries including Ireland, is shown in Table 10.6.

Table 10.6: Extent of the 380 kV / 400 kV AC OHL and UGC Installations in Western Europe[120]

Country	Overhead Line (km)	Underground Cable (km)	% Cable
Belgium	1,335	0	0.00%
France	21,361	3	0.01%
Germany	20,237	70	0.34%
Great Britain	11,979	229	1.91%
Island of Ireland	439	0	0.00%
Netherlands	2,061	30	1.43%
Portugal	2,236	0	0.00%
Spain	19,567	55	0.28%
Sweden	10,700	8	0.07%
Switzerland	1,780	8	0.45%

(Source: ENTSO-E Statistical Yearbook 2011)

84. 400 kV OHL technology conventionally utilises steel lattice towers to support the electricity conductors. As the construction of a 400 kV OHL requires limited civil works with a simple mechanical construction, it is very cost effective compared to an equivalent UGC system which has a more complicated construction and design.

85. 400 kV OHLs have a high level of availability for service, that is, most faults are temporary and automatically cleared without impacting the integrity of the transmission network, and the permanent or persistent faults can be located easily and quickly repaired. Where there is a temporary fault (e.g. a lightning strike), restoration can occur within a number of seconds. In the case of permanent faults, restoration times are on average, less than 48 hours.

86. Compared to equivalent UGCs, 400 kV OHLs result in a relatively low physical impact to the land they cross (limited to the tower locations and land within the OHL corridor). It is a very flexible technology

[120] Denmark is deliberately excluded from Table 4.6 as it is a special case and is discussed in greater detail later in the chapter.

which can be routed and constructed in a wide variety of topographies. With longer spans it can also be constructed to pass over waterways or obstacles.

87. HVAC OHL technology is considered international best practice and is a proven technical solution for transmission of high voltage electricity. It is the technology around which the transmission network in Ireland has been developed to date. It is the clear position of the respective applicants, based upon professional and technical expertise, extensive experience, and international best practice that, on the grounds of achieving an overall balance between environmental, economic and technical objectives, the approach to the establishment and routing of high voltage transmission circuits in rural areas will normally be effected through an OHL construction methodology (refer to Chapter 5 of the Consolidated ES).

10.2.9.3 High Voltage AC Underground Cable (UGC)

88. High voltage UGC technology involves installation of specialised insulated cables under the ground. The cables can either be direct buried or placed within ducts / concrete trenches or tunnels. Direct burial installation requires the use of heavy equipment along the entire length of the route, not only for excavation but also for the transport and installation of the cables. However, it does not require the level of civil engineering required by cut and cover tunnels and deep bore tunnelling type installations. Cable tunnels in contrast to cable trenches are very costly to build and are normally used over short distances and typically only in densely developed urban areas where lack of space precludes the use of OHLs and direct buried cables.

89. The installation of direct buried UGC is highly dependent on soil type. There are two main influences: excavation and backfill. Trenching for UGC requires the excavation of significant quantities of soil. The suitability of the excavated soil as a backfill material and its thermal resistivity are important considerations. Special techniques such as directional drilling are also used for crossings under roads, railways and waterways resulting in a reduced disturbance to the surrounding environment.

90. In terms of reliability of UGCs, reference is made to the most comprehensive study to date carried out by Cigré Update of Service Experience of HV Underground and Cable Systems, ISBN 978 -2-85873-066-7 (2009). This study was based on the results of a survey of 73 utilities from around the world. The study found, that once located, the average time taken to repair a fault on a 400 kV XLPE cable (a cable type which would be considered for the proposed interconnector) is 25 days if the cable is direct buried, and 45 days if installed in a tunnel. On the basis of potential for prolonged unplanned circuit outages, 400 kV OHLs are therefore considered to have a better service availability than equivalent UGCs (this is discussed in greater detail in Section 10.2.8).

91. Long term reliability is also considered to be an issue. The expectation and international experience is that as an UGC gets older, it becomes less reliable. This is principally due to deterioration of the material used in the manufacture of the cable and the long term impact of electrical and thermal stresses over the operational life of the cable.

92. In relation to the use of UGC for HVAC transmission, the high capacitance of the cable presents design and operational difficulties. The most notable of these is the risk of temporary high voltages within the network which exceed the rating of the cable and can cause critical failure of either the cable equipment or transmission assets in a wider area. The TEPCO report and subsequent internal analysis has shown that equipment ratings could be exceeded.

93. The IEC Report recommended against using a total HVAC UGC solution for this particular project advising that “AC cables are technically possible, but have never been found attractive for long distance, high power transmission” and “For AC connections, the solution by underground cables is only used for limited distances”. In fact, there are no 400 kV HVAC UGC in the world that approach the length required for the proposed interconnector.

94. One of the main advantages of installing UGCs is the reduction in landscape and visual impacts associated with the OHL option. However installing buried cables across the country side introduces environmental issues specific to that technology, e.g. potential impact on archaeology as a result of excavation works and permanent loss of habitat due to removal of hedgerows.

95. Because of their higher cost and lower level of availability for service, high voltage transmission cables are generally only used in urban areas or wherever a constraint has been identified such that no alternative exists other than to use a cable. In Europe some examples of circumstances where such cables have been used would be :

- In densely populated areas and where no alternative exists;
- In congested areas of infrastructure where no alternative exists;
- Where it is necessary to cross water and no alternative exists; and
- Where no alternative exists but to route through an environmentally sensitive area and undergrounding is deemed to be less of an impact on the environment.

10.2.9.4 Undergrounding the Entire Interconnector Using AC UGC

96. In 2009, when preparing their respective applications for approval that were submitted that year, EirGrid and NIE considered the option of undergrounding the proposed interconnector using AC UGC. EirGrid's and NIE's conclusion at that time was that the entirely undergrounded AC alternative would not be an acceptable solution as:

- It would not be the least cost technically and environmentally acceptable solution; and
- Its use would not be in compliance with good utility practice.

97. Many of the objectors to those applications disagreed with EirGrid's and NIE's conclusion, and referenced, either directly or indirectly, the Askon Report (Study on the Comparative Merits of Overhead Lines and Underground Cables as 400 kV Transmission Lines for the North-South Interconnector Project) which was commissioned by North East Pylon Pressure (NEPP) in support of their contention that the development should be undergrounded.

98. The IEC reviewed the Askon Report as part of its review of the proposed interconnector. The IEC went stated that it had found "several questionable statements" in the Askon Report. The more significant of these were:–

- The IEC does not agree with the Askon Report when it states that long 400 kV AC UGC "are not really a problem and that experience is there". The IEC found that there are no 400 kV UGC circuits in the world that approach the length required for the proposed interconnector and that this is because of sound technical reasons;
- The analysis by Askon of the reliability of AC UGC circuits is not valid as it "is not backed up by actual data"; and
- The costs estimates for AC UGC in the Askon Report are significantly understated as insufficient provision is made for the cost of installation.

99. Overall, the IEC concluded that the findings of the Askon Report "are not consistent with industrial practice for other projects in Europe" that are similar in size and form to the proposed interconnector and which "have been executed, are under construction or are in planning". The IEC Report goes on to make only one recommendation and that is that the proposed interconnector should not be implemented using the entirely undergrounded AC cable option.

100. The position of the IEC regarding the Askon Report is consistent with SONI's position on that report. Having reviewed the undergrounding issue as part of the re-evaluation process and, in particular, having considered the IEC Report, SONI concurs with the recommendation of the IEC that the proposed interconnector should not be implemented using the entirely undergrounded AC cable option.

101. Undergrounding the entire interconnector, approximately 135km in length, using AC UGC is therefore eliminated from further consideration for this development.

102. During public consultation some stakeholders suggested that consideration be given to an offshore cable that is a submarine cable off the east coast, for linking the two transmission networks on the island of Ireland. As an AC offshore option would require an even longer length of AC cable than the approximately 135km length of the on land option it is also eliminated from further consideration for this development.

10.2.9.5 High Voltage AC XLPE UGC and Extent of its Use

103. Although the entirely undergrounded AC option was eliminated, the option of using a hybrid AC solution, i.e. a combination of AC UGC and AC OHL, commonly referred to, and herein after referred to, as 'partial undergrounding', remained an option for consideration. Indeed the IEC found in this regard that the partial undergrounding is technically feasible but within limitations on the cumulative length of the UGC sections. It is appropriate therefore that consideration continue to be given to the use of high voltage AC UGC for this development but within these recognised constraints.

104. XLPE (cross linked polyethylene) insulated cable is the 'state of the art' for HVAC UGC in the world today. NIE and SONI adopted the use of high voltage XLPE cable at an early stage in its commercial development. There have been 275 kV and 110 kV XLPE cables installed in Northern Ireland . The installation of long lengths (greater than 1000 metres) of 400 kV XLPE UGC only became possible in the late 1990s with the development of a suitable cable joint for connecting lengths of such cable together.

105. In the period 1997 to 2009, eleven significant 380 kV / 400 kV XLPE projects[121] (i.e. projects that involved a circuit length in excess of 2km) were completed in Europe. The longest of these was the 20km long Elstree - St John's Wood 400 kV cable project in London. This cable is installed in a three metre diameter air conditioned tunnel. The combined circuit length of these eleven European 'projects of significance' amounts to approximately 196km[122], with a cumulative single phase cable length of some 640km. It should be noted that a minimum of three single phase cables is required per circuit.

106. If the proposed interconnector was to be implemented in its entirety using 400 kV XLPE cable, it would require approximately 810km (2 X 3 X 135km[123]) of single phase cable. This means that this single project would require more 400 kV XLPE cable to be installed on the island of Ireland (in one circuit) than has been installed throughout Europe during the period 1997 to 2009. It appears, based on an analysis of reports (Europacable, Cigré T&D World[124]) of major EHV (extra-high voltage - in the range 315 kV to 500 kV) UGC projects carried out across the world in the fifteen year period up to 2012, that if the proposed interconnector was to be implemented entirely using UGC, there would be more EHV XLPE cable installed on the island of Ireland than in all of mainland Europe or in North America.

107. In contrast to the relatively small quantity of EHV UGC that has been installed in Europe during the period 1997 to 2009, it is interesting to note that in the period 2000 to 2009 over 10,000km of EHV OHL was installed in mainland Europe (17 member states of UCTE[125]). The reason for this overwhelming

[121] ENTSO-e & Europacable Joint paper to EU Commission: Feasibility and technical aspects of partial undergrounding of extra high voltage power transmission lines, December 2010, available at http://ec.europa.eu/energy.

[122] In the case of some of these projects the circuits consisted of two cables per phase giving a total of six single phase cables per circuit.

[123] The distance of 135 km is derived from the length of the route identified by PB Power in its 2009 report. The requirement for two cables per phase is also identified by PB Power in that report. There are three phases in the AC system.

[124] Transmission and Distribution World magazine, available at http://www.tdworld.com

[125] UCTE is an association of Transmission System Operators from mainland Europe (excluding Scandinavia and the countries of the former USSR). UCTE is now a part of ENTSO-E. The data was obtained from the UCTE Statistical Yearbooks 2000 and 2009.

preference among UCTE members for OHL can be clearly understood in a letter[126] , dated 14 January 2008, from the Secretary General of the UCTE to APG (the Austrian Power Grid Company) wherein it states:

> *"For the time being 400 kV AC cable systems cannot compete with overhead power lines in the transmission grid. Using cables for lines in interconnected operation (400 kV backbone) presents serious technical, financial and environmental drawbacks."*

and

> *"UCTE therefore recognizes overhead power lines as the most reliable and most secure technical solution for transmitting electricity over long distances. Furthermore based on different studies within UCTE an overhead line is the more efficient and more economical way for the transportation of electricity compared with underground cables at the 400 kV level".*

108. This overwhelming preference for OHL among European utilities is expected to continue into the future. In this regard, the Ten Year Network Development Plan (TYNDP) 2012[127] issued by ENTSO-E (European Network of Transmission System Operators for Electricity) indicates that in the period covered by the TYNDP, a further 28,400km of new EHV (i.e. greater than 330 kV) AC OHL is planned to be installed in Europe while during the same period only 420km, in predominantly short lengths, of 400 kV AC UGC is planned (p 62). The reason for the preference for 400 kV OHL is explained in the TYNDP (p 81) as follows:

> *"New 400 kV AC OHL projects are in technical, economic, and ecological terms the most efficient solution for long distance electricity transmission. Indeed, such reinforcements integrate straightforwardly into the existing grid since this technology has been the standard for a long time".*

109. It is clear therefore that the electricity utilities of Europe still consider the use of OHL for 400 kV AC circuits to be best practice, and that 400 kV AC UGC is only used in very limited situations and only over relatively short lengths. The installation of 270km (2 X 135km) of 400 kV AC UGC on the island of Ireland in one project, or even in a multiple of different projects, could not be described as complying with good utility practice.

110. During consultation it was stated by numerous stakeholders that the strategy adopted by Denmark for the undergrounding of its transmission grid should be considered as the standard for what constitutes 'best international practice'. SONI does not agree and instead considers 'best international practice' to be the practices, methods and acts engaged in or approved by a significant portion of the electric utility industry in Europe' and not just the practice in a single European country. The practices in a broad range of European countries with regard to the undergrounding of 400 kV transmission circuits are set out above.

111. Notwithstanding the fact that the practice in Denmark is not the determinant for what constitutes 'best international practice' it is useful to consider the Danish strategy. In 2009 a plan[128] was published in Denmark for the undergrounding of the entire 132 kV / 150 kV grid over a period extending to 2040. The plan for the 400 kV grid is however quite different. Even though there appears to be a national desire and a willingness to pay for the undergrounding of the entire 400 kV grid it was determined that it was not achievable due to the technical difficulties, uncertainties and risks associated with the installation of long lengths of 400 kV UGC.

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[126] Available at http://www.eirgridprojects.com/projects/northsouth400kVinterconnectiondevelopment/projectactivity/2008/

[127] Available at https://www.entsoe.eu/major-projects/ten-year-network-development-plan/tyndp-2012/.

[128] Energinet.dk - Cable Action Plan:132 - 150 kV Grids - March 2009.

112. The technical difficulties and risks associated with the installation of long 400 kV UGC are explained in a technical report published by the Committee set up by the Danish Government to develop the strategy for the undergrounding of the transmission grid. At page 19 it states:

> *"When a 400 kV cable is disconnected, the large energy volumes stored in the cable and the cable substations will oscillate and cause overvoltage. The installation of long cables or a large number of short 400 kV cables increases the risk of such phenomena becoming a serious problem. The over voltages may become very large with the ensuing risk of other components being disconnected. This increases the risk of power failures."*

113. It was as a result of these concerns that the Danish Committee recommended that those 400 kV circuits that form the backbone of the transmission grid should not be undergrounded as to do so would carry too high a risk for system security and stability. Based on this it was decided that the required increase in interconnection capacity with Germany would be achieved by constructing a new double circuit 400 kV OHL. This line is now complete and in service since December 2014.

114. It is clear therefore that new 400 kV OHLs are being, and will be, constructed in Denmark. The map of Denmark at Plate 10.5 shows the planned extent of 400 kV grid by 2030. The proposed new OHLs can be seen on this map as solid orange lines.

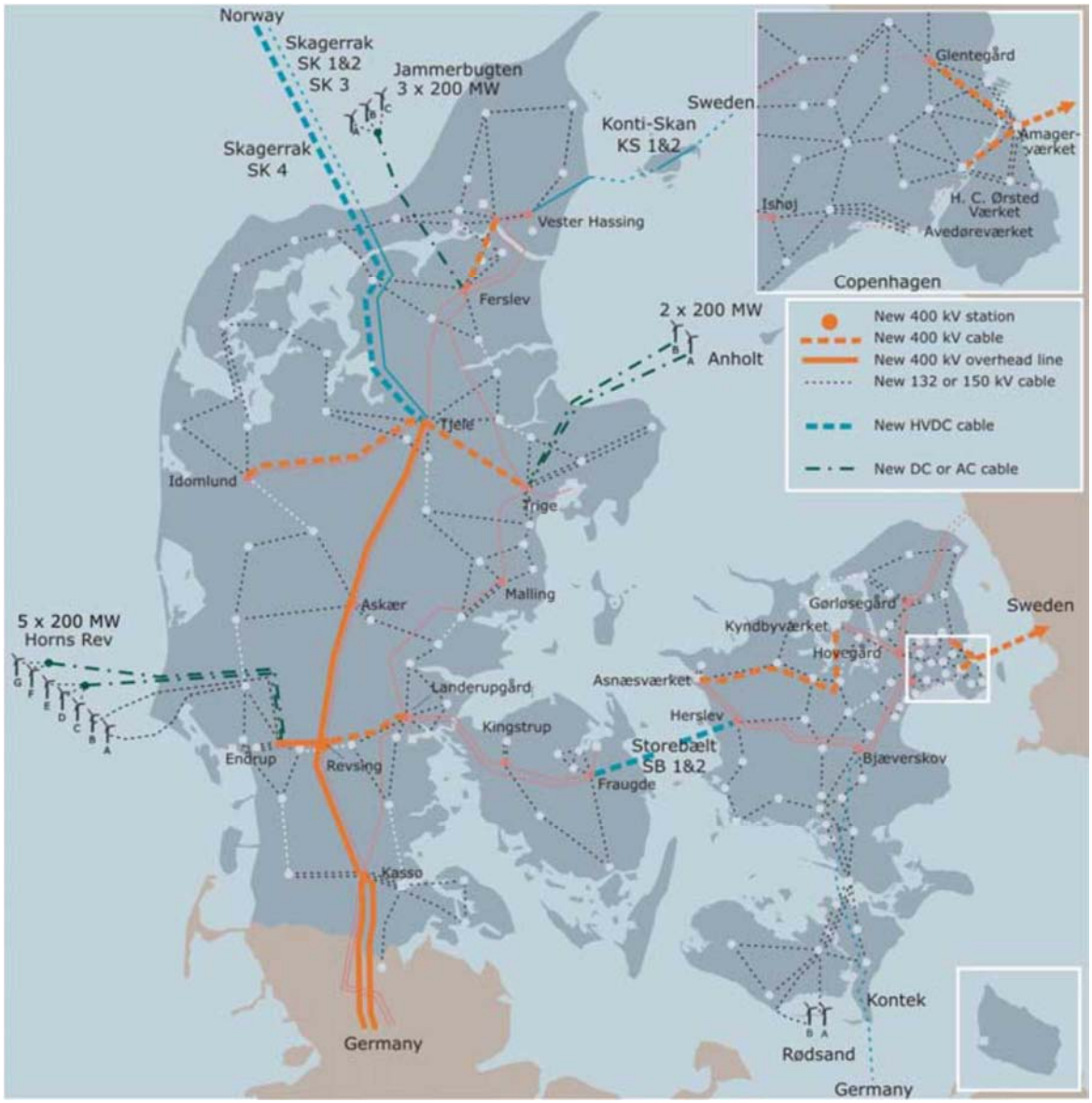

Plate 10.5: Planned 400 kV Infrastructure for the Danish Transmission Network

(Source: Technical Report on the Future Expansion and Undergrounding of the Electricity Transmission Grid – Summary – April 2008)

115. The longest AC UGC in the world, with a voltage rating greater than or equal to 380 kV, is a 40km long cable in Tokyo, Japan. Denmark aspires to having the longest such UGC in the world. However recognising the technical difficulties, uncertainties and risks associated with such long 400 kV UGC a research and development programme has been instituted, in cooperation with Danish universities which, it is hoped, will conclude with the installation and testing of a long length (between 40km and 60km) of 400 kV UGC. The Technical Report states (p.8) that "if targeted efforts are made, these tests can be implemented within 6 – 10 years". If successful, plans will proceed to underground all future "non-vital backbone" 400 kV circuits. The 400 kV circuits proposed for undergrounding over the following decades can be seen on Plate 10.5 as dashed orange lines.

116. The Denmark Cable Action Plan[129] envisages that the expansion of the 400 kV network will proceed as shown in Table 10.6. From this it can be seen that (assuming the technical uncertainties mentioned in

[129] Energinet.dk - Cable Action Plan:132 - 150 kV Grids - March 2009.

the previous paragraph are resolved) approximately 55% (290km) of the expansion will be achieved by means of 400 kV OHLs and the remaining 45% (240km) by 400 kV UGC.

Table 10.6: Denmark 400 kV Network Expansion Plan

Year	400 kV Overhead Line	400 kV Underground Cable
2009	1,270 km	80 km
2030	1,560 km	320 km

10.2.9.6 Reliability Statistics for High Voltage AC UGC and OHL

117. From a transmission adequacy point of view the availability for service, or more correctly the lack of availability for service, of a transmission circuit is a more important measure of reliability than simple 'failure rate'. A circuit's 'availability' is derived from the expected failure rate and the average time it takes to repair a fault.

118. The vast majority of faults on transmission OHLs are **transient** in nature. Most of these are caused by lightning; the lightning does not cause any damage; the fault only exists as long as the lightning exists. The protection systems for the OHLs are designed to trip the line when a fault occurs and, based on the assumption that the fault is transient, will automatically switch the line back into service within one second. If the fault is not transient but a 'permanent' fault then the OHL will re-trip and the line will remain out of service until repair crews can find and repair the fault.

119. In the case of transmission UGCs however almost every failure can be assumed to be a **permanent** fault as usually the very act of failing results in an explosion at the point of failure which destroys a section of the cable.

120. As the time it takes to repair a 400 kV UGC is much greater than the time to repair a 400 kV OHL it can be expected that such an OHL will have a much better level of availability for service than an equivalent UGC and this is supported by system statistics.

121. In April 2009, Cigré published [130]the results of the most comprehensive study of UGC reliability carried out to date (refer to Table 10.7). This study was based on the results of a survey of 73 utilities from around the world. Of interest is the information received on the performance of 1,388km of XLPE cable with a voltage rating in the range 220 kV to 500 kV. Applying the calculated fault rates of this 1,388km of installed cable, to the length of cable[131] (2 x 135 km) that would be required for the proposed interconnector, gives a projected fault rate of 'one fault per annum'.

122. This can be compared to fault rate' and 'average time to repair' of UGC with that of an equivalent OHL. There are 439km of existing 400 kV OHLs in Ireland. This length of 400 kV OHL is too small a sample for determining meaningful performance statistics. Meaningful statistics can, however, be obtained by considering the fault statistics of the combined quantity (approximately 2,245km) of 400 kV, 275 kV and 220 kV OHLs under EirGrid's control[132] . Taking the fault statistics of this existing 2,245km of OHL for the period 2004 to 2012, gives a projected fault rate for the proposed (approximately 140 km long) 400 kV OHL of one permanent fault (that is a fault that requires repairs before the OHL can be returned to service) every 20 years.

[130] Cigré Technical Brochure 379 - Update of Service Experience of HV Underground and Submarine Cable Systems, ISBN 978 -2-85873-066-7 (April 2009).

[131] The distance of 135km is derived from the length of the route identified by PB Power in its 2009 report. The requirement for two cables per phase is also identified by PB Power in that report.

[132] This is reasonable compromise because the existing 220 kV and 275 kV OHLs are of similar design and experience similar operating conditions to that of the existing 400 kV OHLs.

123. The statistics also show that the average duration that a 400 kV / 275 kV / 220 kV OHL circuit will be out of service for repair after a fault is considerably less than that of an equivalent UGC circuit - less than two days in the case of OHLs, and 25 days in the case of a 400 kV UGC. This is summarised in Table 10.7.

Table 10.7: Summary of Comparative OHL and UGC Statistics

UGC and OHL	Projected Fault Rate for N-S Interconnector	Average Time to Repair
UGC – directly buried cable (statistics based on 1,388 km of XLPE cable with a voltage rating in the range 220 kV to 500 kV) **Source:** Cigré Technical Brochure 379	1 fault per annum	25 days
OHL (statistics based on 2,245km of 220 kV, 275 kV and 400 kV OHL in Ireland) **Source:** EirGrid & SONI (2004 – 2012)	1 fault (permanent fault requiring repairs) every 20 years	Less than 2 days

124. The comparative analysis indicates that OHLs have a substantially better level of availability for service than UGCs. This result is consistent with the findings of the independent Ecofys Report[133] in which the 'availability' (the term Forced Outage Rate is used in the report) of OHLs was found to be at least ten times (at least one order of magnitude) better than that of UGCs. This comparative performance must always be a factor when a TSO is considering UGC particularly when the circuit in question is to be a backbone circuit of the transmission network and therefore of the highest strategic importance.

10.2.9.7 The World's Longest High Voltage AC XLPE Cable Circuits

125. The longest high voltage AC XLPE cables operating in the world today are submarine cables. The longest is the 105km long 90 kV 40 MW interconnector from Great Britain to the Isle of Man. The record for the longest HVAC cable in the world is likely to be broken when the proposed 125km[134] long 220 kV and 200 MW interconnector between the islands of Sicily and Malta is commissioned (expected June 2015). These long cables are radial connections and as such they do not form part of a meshed transmission network, unlike the proposed interconnector. They also have a much lower power carrying capacity than that which is required of the proposed interconnector (i.e. 1,500 MW). The environmental impacts of UGC, the technical difficulties of UGC, and the cost of UGC increase rapidly with increase in voltage rating and power carrying capacity. These examples of long HV undersea cables are therefore in no way comparable with the requirements of the proposed interconnector.

126. The longest 'on-land' AC XLPE cable circuit, with rated voltage of 400 kV or higher, operating in the world today is a 40km double circuit cable in Tokyo, Japan. These 500 kV, 900 MW cables were commissioned in 2000. The longest such cable in Europe, at 20km, is the Elstree - St John's Wood 400 kV 1,600 MW circuit in London, which was commissioned in 2005. Unlike the long undersea cables, these cables have power carrying capacities, and voltage ratings, that are comparable with that of the proposed interconnector: There, however, the similarities end, in that:-

[133] Study on the Comparative Merits of Overhead Electricity Transmission Lines Versus Underground Cables, carried out by Ecofys on behalf of the Irish Department of Communications, Energy and Natural Resources and available at www.dcenr.gov.ie.

[134] The circuit consists of 100km of submarine cable plus 25km of on-land UGC.

- The cables in London and Tokyo are installed under the streets and buildings of two of the largest cities in the world. Both of these cable circuits are installed in air conditioned tunnels. The proposed interconnector would traverse open farm land in the main;
- The proposed interconnector UGC route (as identified by PB Power) is about 135km in length. The cables in London and Tokyo are a fraction of this length. The technical difficulties associated with long lengths of EHV UGC increase with increase in circuit length; and
- The transmission networks in Great Britain and Japan are orders of magnitude bigger and therefore unlike Ireland are far better able to accommodate such long lengths of EHV UGC.

127. One of the project objectives / design criteria for the proposed interconnector, , is that it will have a power carrying capacity in the region of 1,500 MW and connect between appropriately robust points on the transmission networks north and south of the border. To try to achieve this using an entirely UGC option would require the installation of two circa 135km-long UGC circuits. It is clear from the above that no country in the world has ever implemented such a project, or anything comparable. It is also evident from ENTSO-E's Ten Year Network Development Plan 2010-2020 that there are no plans to install anything comparable in Europe in the next ten years.

128. It is concluded therefore that to implement the proposed interconnector using long lengths of high voltage AC UGC would not comply with good utility practice.

10.2.9.8 Cost Comparison of AC UGC and AC OHL

Capital Costs

129. Three separate comparative studies of UGC versus OHL were carried out in Ireland during the period 2008 / 2009 as follows:

- Askon Report (commissioned by North East Pylon Pressure (NEPP)),
- Ecofys Report (commissioned by the DCENR) and
- PB Power Report (commissioned by EirGrid / NIE) supplemented by the PB Power Technical and Costs Update (April and July 2013).

130. The studies found that the capital cost of UGC ranged from three to eight times that of an equivalent OHL.[135]

131. The most up to date site specific comparative cost estimate available for this development can be found in the PB Power Update Report, Supplementary Note of July 2013. This report found that the AC UGC option would cost €740 million[136] more than the proposed 400 kV OHL.

132. The extent of the cost differential between AC OHL and AC UGC is so great that, and regardless of the additional technical problems of UGC, if SONI is to comply with its statutory obligations it effectively discounts using UGC for any significant length in this development.

Life Cycle Costs

133. During public consultation it was generally acknowledged by objectors to the OHL option, that the capital cost of UGC was much greater than that of OHL. It was however, often asserted that UGC is more efficient than OHL and that over its life cycle a UGC would incur lower electrical losses and, therefore, lower operating costs than an equivalent OHL. It was further stated that if the cost of the two

[135] Note: As these studies were only interested in calculating the cost differential between the options, they did not include in their estimates provision for project costs that are common to all options. Their cost estimates for each option cannot therefore be considered as 'whole of project' cost estimates.

[136] Based on the exchange rate in March 2015: £537 million

technologies were compared over a typical life cycle, then UGC might well prove to be the more cost effective option.

134. These assertions are incorrect as they are based on a misunderstanding of transmission networks operation. UGCs and OHLs have different electrical characteristics with the result that a lightly-loaded UGC (typically less than 50% loaded) will have higher electrical losses than an equivalent lightly-loaded OHL, while a heavily-loaded UGC (typically greater than 50% loaded) will have lower losses than a heavily-loaded OHL. This is well illustrated in the graph in Plate 10.6 which compares the energy losses of a 400 kV OHL 1,500 MVA circuit with two 400 kV UGC alternatives (2 X 1,200 mm² and 2 X 1,600 mm² aluminium cables) of comparable capacity. The breakeven point (crossover point) for the 1,200 mm² UGC (in comparison with the OHL) is 900 MVA while the comparable breakeven point for the 1,600 mm² UGC is lower at 840 MVA.

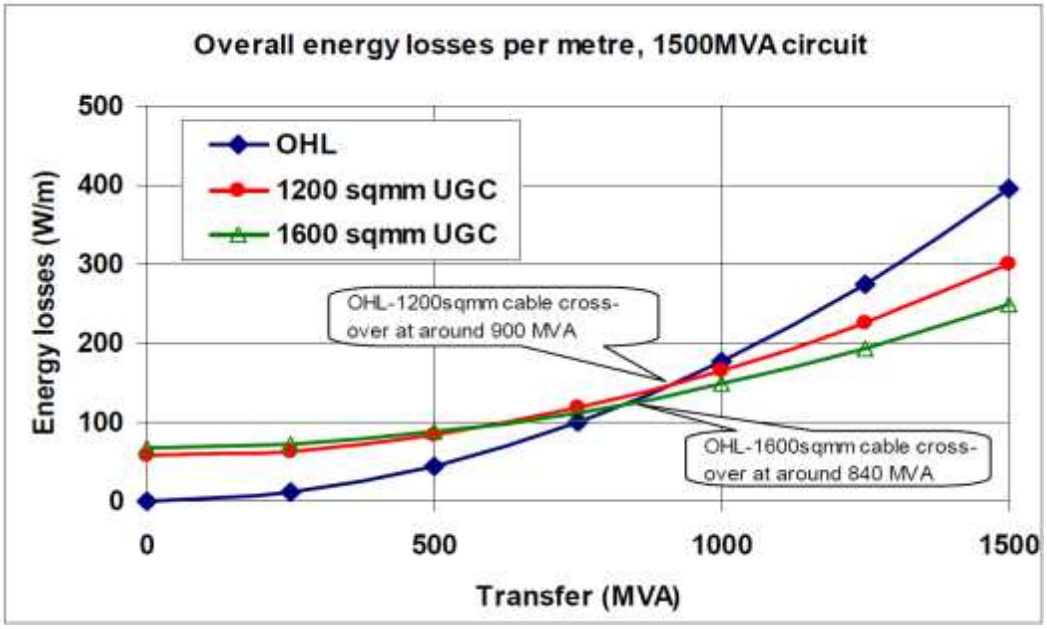

Plate 10.6: Comparison of Energy Losses for OHL and UGC

(Source: Figure 3-7 PB Power Report (2009))

135. Circuits in a meshed transmission network are required, under normal system conditions, to have a contingency capacity. In other words, they are required to have sufficient spare capacity to cater for the sudden loss of another circuit on the network. In practice, this means that transmission circuits, and particularly backbone circuits, typically operate at less than 50% of their power-carrying capacity. Therefore, OHL transmission circuits incur lower electrical losses than equivalent UGC transmission circuits during their lifetime. This is confirmed, in the case of the transmission networks of mainland western Europe, in the letter from the Secretary General of UCTE (as previously referenced), dated 14 January 2008 to the Austrian Power Grid Company (APG), in which it was stated that, "based on different studies within UCTE an overhead line is the more efficient and more economical way for the transportation of electricity compared with underground cables at the 400 kV level".

136. The average energy transfer on the proposed interconnector, over its lifetime, is expected to be less than 33% of its nominal power carrying capacity. This is on the basis that the peak load on the circuit (under normal system conditions) should not exceed 50% of capacity[137]. It is therefore the case that using OHL for the new interconnector will incur lower electrical losses than using equivalent UGC alternative.

[137] See Section 9.2.2 of the Ecofys Report (summarised in Table 4.3) for further discussion on this point.

137. The PB Power Update Report of 2013 estimated that over its lifetime the cost of operating and maintaining the proposed 400 kV OHL would be €55 million[138] while the comparable cost for the UGC option would be €90 million[139]. This estimate was based on an assumed average loading of 33% of capacity (500MVA).

10.2.10 Partial Undergrounding of AC Transmission Circuits

10.2.10.1 Background to Partial Undergrounding

138. In the context of this ES Addendum, 'partial undergrounding' is the term used to describe the undergrounding of a short section, or short sections, of a long transmission circuit that is comprised predominantly of OHL.

139. As the use of any HVDC technology, whether OHL or UGC is not an appropriate or acceptable option for this development (refer to Section 10.2.9.2), the following consideration of partial undergrounding is restricted to high voltage AC technology and has little or no relevance to HVDC technology.

140. Partial undergrounding of 110 kV circuits is common practice in Ireland. There are no examples of partial undergrounding at the 400 kV level in Ireland however there are numerous examples elsewhere in Europe. Partial undergrounding of 400 kV AC circuits is therefore technically feasible.

141. In the 2009 ES, it is stated that the joint development philosophy of EirGrid and NIE for the proposed transmission line, which will follow an alignment across a rural area, is "firstly to seek a viable and environmentally acceptable OHL solution; the use of short lengths of UGC will only be considered in the event that an OHL solution cannot be found, and where it can be confirmed that the use of UGC does not exceed the system's capacity to absorb such cables".

10.2.10.2 Consideration of Partial Undergrounding for the Proposed Interconnector

142. When considering partial undergrounding for a 400 kV project, it is essential to understand the environmental, technical and cost implications of such a development. These issues are assessed in general terms in a joint position paper prepared by Europacable and ENTSO-E that was submitted to the European Commission in December 2010 (Feasibility and Technical Aspects of Partial Undergrounding of Extra High Voltage Power Transmission Lines (December 2010)). The joint paper "merges the experience European Transmission System Operators (TSOs) have gained with the inclusion of underground EHV cables into their transmission networks over many years with the technical expertise of the leading XLPE EHV cable systems manufacturers in Europe". The implications, for the proposed interconnector are considered below.

10.2.10.3 Partial Undergrounding – Environmental Issues

143. The size of the AC UGCs required for the proposed interconnector would be such that they could not be installed under public roads or under the disused railway line, as these roads and railways are not sufficiently wide. The only practical option would be to install the cables directly across farmland. This would have the following environmental implications:

- The construction effort associated with the installation of the UGC section would be considerably greater than that of the OHL. The UGC would require a construction swathe of 20 to 22 metres, as wide as a dual carriageway, to be cut through the countryside. This would result in much greater disruption to farming and other activities during the construction phase than would arise from the construction of the OHL.

[138] Based on the exchange rate in March 2015: £40 million

[139] Based on the exchange rate in March 2015: £65 million

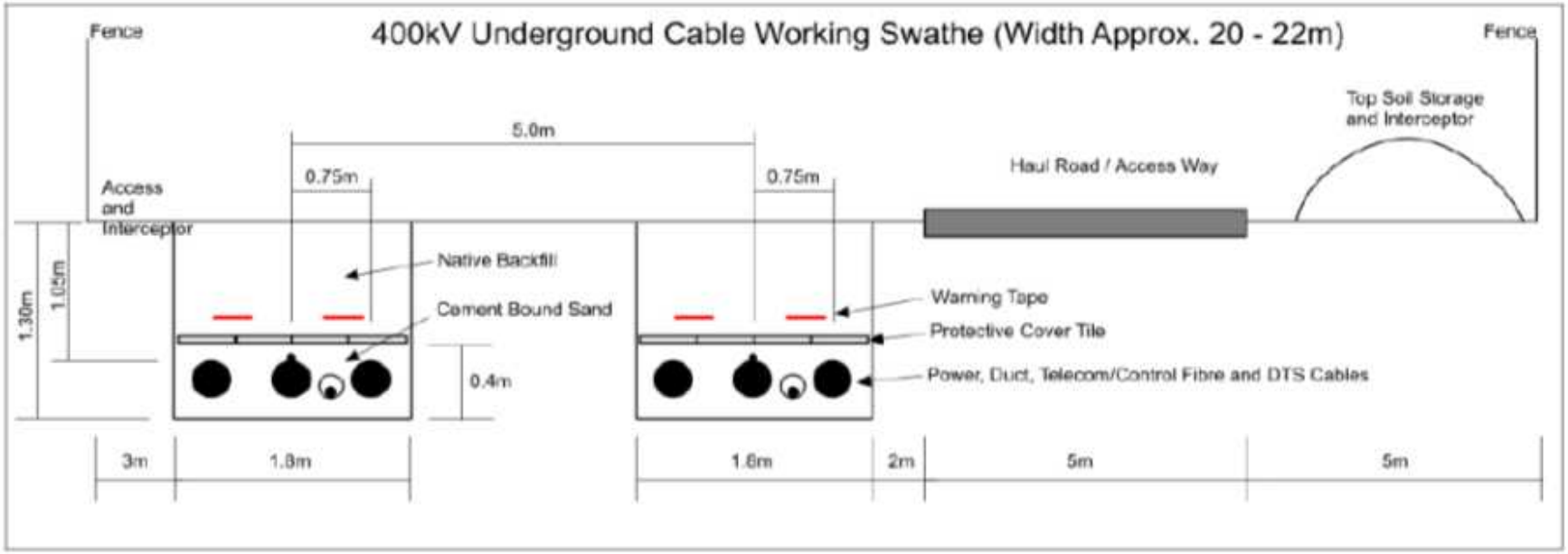

Plate 10.7:400 kV Single Circuit, Two Trench, Working Swathe

(Source: Figure 7.1(b) *PB Power Report* (2009))

- The UGC construction swathe would cut through every hedgerow in its path, leaving a permanent gap. The hedgerow would not be allowed to re-establish itself as deep rooted vegetation cannot be permitted to grow in proximity to UGCs.

Plate 10.8: Photographs of a 400 kV Double Circuit Cable Being Installed Cross-Country

(Note: The first photograph shows the construction swathe with one trench and the haul road, the second photograph shows the construction swathe with two open trenches and haul road in the centre – Source National Grid Company, UK.)

- This is unlike the case of the OHL where in many cases the OHL will oversail hedgerows without unduly interfering with them. Where a tower is positioned straddling a hedgerow, a section of the hedgerow will be removed during construction, but it can be allowed to re-establish itself afterwards (see Plate 10.9), and management of the hedgerow thereafter will be required only to prevent its interference with the OHL.

Plate 10.9: Photograph of a Tower Straddling a Hedgerow with Vegetation Re-established

- Two underground chambers would be constructed approximately every 650m along the UGC route to accommodate the 400 kV cable joints. At these locations two inspection enclosures, either underground chambers accessed via a surface manhole or above ground kiosks similar to that shown in Plate 10.10 are required.

Plate 10.10: Photograph of Above Ground Inspection Kiosks for UGC

(Source: PB Power (2009) Report, page A6 11)

- No buildings are permitted within a UGC reserve[140]. Buildings can, and have been, constructed below high voltage OHLs, most notably in the UK.

[140] Note: This applies where the cables are buried directly into the ground. If the cables are installed in a tunnel, and can be accessed via the tunnel, then buildings and other infrastructure can be constructed above, provided there is sufficient clearance.

- It would be necessary to have a substation at every location where the 400 kV circuit changes from OHL to UGC. Where a substation is required solely for the purpose of accommodating a transition from UGC to OHL, it is known as a 'transition station' or as a 'sealing end compound' (see Plate 10.11). A typical 400 kV transition station has the same appearance as a small 400 kV substation. It would require a land take of about one-half of a hectare. It would consist of an inner compound enclosing the live equipment and a small building, with a buffer strip around the compound to accommodate an earth berm, and / or vegetation, for screening and an access road.

Plate 10.11: Representation of a Sealing End Compound within the Study Area

10.2.10.4 Partial Undergrounding – Technical Issues

144. Inserting a section of UGC into an OHL circuit will have a negative effect on the reliability performance of the overall circuit. The latest performance statistics confirm that, on a kilometre for kilometre basis, 400 kV OHLs have a much better service availability record than 400 kV UGCs.

145. The risk to transmission system stability associated with the installation of a long length of EHV UGC exists, regardless of whether that long length of cable forms an entire UGC circuit, a single section of partial undergrounding, or is made up of multiple shorter sections of UGC within a single hybrid OHL / UG circuit. As a result, some utilities have set down the maximum permissible length of EHV UGC that can be installed on their transmission system whether installed as a single UGC circuit or as part of a hybrid UGC / OHL circuit and the maximum permissible cumulative length of EHV UGC on the system. In the Netherlands, for example, the maximum permissible length of a single 400 kV UGC is 20km. It is also the case that the longest 400 kV UGC in Europe is a 20km cable installed in an air conditioned tunnel in London.

146. When considering what should be the maximum permitted length of 400 kV UGC on the island of Ireland, the respective applicants must take account of the accompanying risk of failure and consequence of such failure. The transmission system on the island of Ireland is much smaller than that on the island of Great Britain and of course much smaller than that of mainland Europe, to which the Dutch system is a part. The transmission system on the island of Ireland is therefore able to accommodate much shorter lengths of 400 kV UGC than is the case in Great Britain or the Netherlands, for example.

147. Accordingly careful consideration was given to the issue of partial undergrounding as part of the overall re-evaluation process. Based on the present extent and configuration of the island of Ireland network, EirGrid and SONI consider that the maximum length of 400 kV UGC that would be technically feasible to install as part of the proposed interconnector (inclusive of that part of the interconnector located in Northern Ireland) is approximately 10km, whether installed in one continuous length or in an

accumulation of shorter lengths. However, there are a number of environmental factors and costs issues which must also be considered in any appraisal of the alternative technological option of partial undergrounding.

10.2.10.5 Partial Undergrounding – Cost Issues

148. The PB Power Technology and Costs Update Report[141] of July 2013 (see Table 10.1) contains the most up-to-date detailed site specific cost comparison of UGC and OHL for the proposed interconnector. The Update Report found (Table 8-16 on page 27) that AC UGC would cost on average €5.4 million[142] per km more to install than the AC OHL.

149. At least one, and potentially two, transition stations are required for each section of the circuit that is undergrounded. Depending upon the length of an underground section (and therefore the facilities required at each end), transition stations could add an additional €5 - €15 million[143] (approximately) per installation.

150. Unlike OHL, long sections of UGC would require electrical compensation equipment to be installed along its route to counteract the effects of the underground cable on the transmission network; a 10km section of UGC would require around 0.5 hectares of land to accommodate such equipment. The costs for this transition station compensation equipment are included in the overall cost estimate updates for the AC UGC option but may not be required for short sections of partial undergrounding - hence the spread in estimated costs. Likewise, the land-take of the transition station for a short section of undergrounding which would not require the installation of reactive compensation equipment could be reduced to around 0.3 hectares.

10.2.10.6 Conclusion on Partial Undergrounding for the Proposed Interconnector

Partial undergrounding is feasible if:

- The length to be undergrounded is restricted, for technical and operational reason, to less than approximately 10km in one continuous length or an accumulation of shorter lengths; and
- The cost of using the short length(s) of UGC can be proven to be an environmentally advantageous and cost-effective way of overcoming an otherwise unavoidable environmental or technical constraint to the preferred OHL.

151. Neither of the respective applicants have identified any section of the route of the proposed interconnector where the above applies and are therefore proposing that the entire 400 kV circuit be implemented using 400 kV AC OHL.

[141] Cavan-Tyrone and Meath-Cavan 400 kV Transmission Circuits: Technology and Costs Update – Addendum to the 2009 Report and Supplementary Note – July 2013 by Parsons Brinckerhoff.

[142] Based on the exchange rate in March 2015: £4 million

[143] Based on the exchange rate in March 2015: £4-£11 million

10.3 Partial Undergrounding as Landscape Mitigation

152. In its role as competent authority for PCI, An Bord Pleanála in the Republic of Ireland examined the draft application file in respect of EirGrid's proposed North-South 400 kV Interconnection Development, in accordance with Article 10.4(c) of Regulations 347/2013 (the PCI Regulation). It subsequently requested that certain specified "missing information" be submitted. Included in the list of missing information is the following request relating to partial undergrounding:

> *"Where significant impacts on landscapes/demesne landscapes are identified, the EIS should address the potential for partial undergrounding of the line to mitigate those impacts".*

153. As is set out in the EirGrid EIS (June 2015) and as is reproduced in Appendix 10.1 of this Addendum, a key constraint to the use of partial undergrounding of the overall HVAC circuit, is that the length of HVAC underground cable which is technically feasible for the entire proposed interconnector, both in the Republic of Ireland and Northern Ireland, is approximately 10km.

154. As outlined in Appendix 10.2 (Partial Undergrounding Report), this limitation of 10km of partial underground cable applies in combination to both Northern Ireland and the Republic of Ireland. For this reason the Partial Undergrounding report considers partial undergrounding as a potential landscape mitigation measure in Northern Ireland in addition to the Republic of Ireland, albeit recognising that the report is prepared in response to a request from the PCI competent authority in the Republic of Ireland and not Northern Ireland.

155. Partial undergrounding would involve constructing a starting transition station and a finishing transition station. Between these stations the proposed interconnector would be buried as a cable and so towers would not be required along these sections. As noted above, a constraint to the use of partial undergrounding, is that the length of undergrounding which is technically feasible for the entire proposed interconnector, both in the Republic of Ireland and Northern Ireland, is approximately 10km.

156. The methodology for the consideration sought to identify the locations where undergrounding might have the most effective mitigating effect on identified significant and sensitive landscapes impact. The use of this approximate 10km length might be in one location, or the use of shorter lengths of partial undergrounding might be considered in more than one location, while bearing in mind the absolute need for, and consequent potential impact of, the above-ground transition stations required at each end of that partially undergrounded portion of the alignment.

157. The process starts with a listing of locations where significant landscape and visual impact has been identified. Following this, the impacts that can feasibly be mitigated by partial undergrounding are identified. Some impacts are so dispersed that partial undergrounding of 10km can be excluded as having no potential to mitigate landscape impacts due to the amount of transition stations required.

158. One of the areas considered for partial undergrounding was within Northern Ireland - the Benburb Area. Receptors in the area include:

- Tullydowey House Gate Lodge;
- River Blackwater, Counties Tyrone and Armagh;
- Tullydowey House;
- National Cycle Route 11 and River Blackwater Canoe Trail; and,
- Benburb as a settlement and constraints within (e.g. Benburb Priory and Benburb Castle).

159. Consideration was made of a number of environmental topics within each area under consideration in both Northern Ireland and the Republic of Ireland. These topics included Agronomy, Ecology, Soils, Geology, Hydrogeology, Water, Cultural Heritage, Traffic and Landscape effects. It was acknowledged that the partial undergrounding would have reduced impacts in terms of landscape and cultural heritage. However it was considered there was no justification for, or greater benefit of, partial

undergrounding at this location in the Benburb Area over the proposed overhead line for this location at Benburb. The partial undergrounding option at Benburb would create greater adverse impacts (agronomy, ecology, soils, geology, hydrogeology and traffic) than the overhead line.

160. This consideration of the potential for partial undergrounding of the proposed circuit in for the Benburb Area reflected the consideration in respect of sites in the Republic of Ireland. For each of the locations identified and evaluated in the Republic of Ireland, it was concluded that there is no overriding justification for, or benefit of the provision of partial undergrounding when compared to the proposed interconnector, i.e. the overhead line design.

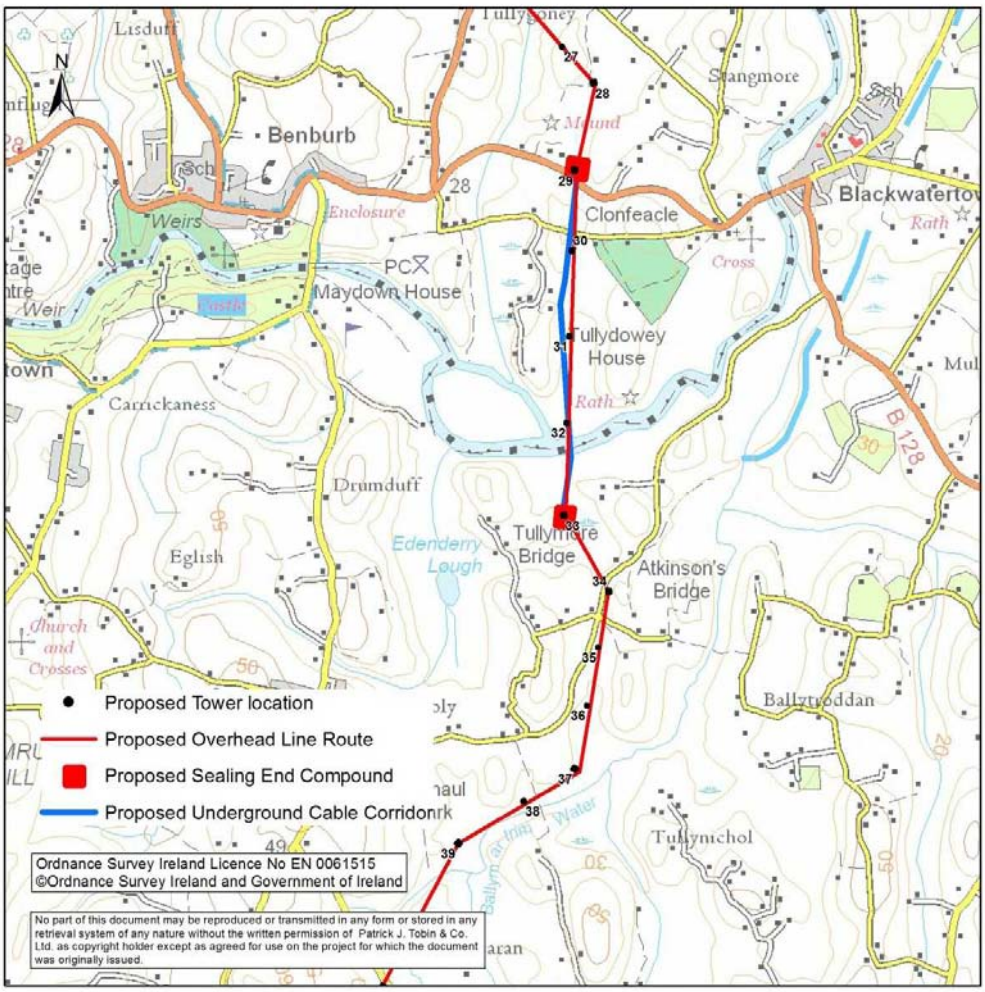

Plate 10.12: Partial Undergrounding Proposed Option within Northern Ireland: Benburb Area (Towers 29 – 33)

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Chapter 11 Noise Assessment



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11 Noise Assessment

11.1.1 Overview

1. Two of the main British Standards dealing with the assessment of noise or providing guidance on acceptable noise limits in buildings have been revised since the publication of the Consolidated ES. They are BS4142:2014 *Methods for rating and assessing industrial and commercial sound* and BS8233:2014 *Guidance on sound insulation and noise reduction for buildings.* The main changes to the British Standards as they may affect the assessment are discussed.

11.2 BS4142:2014 Methods for rating and assessing industrial and commercial sound

2. A revision of the British Standard was published at the end of October 2014 and replaces the previous 1997 edition.

3. The response to sound can be subjective and is affected by many factors, both acoustic and non-acoustic. The significance of its impact, for example, can depend on factors such as the margin by which a sound exceeds the background sound level, its absolute level, time of day and change in acoustic environment as well as local attitudes to the source of the sound and the character of the neighbourhood. The new edition of the standard recognizes the importance of the context in which a sound occurs.

4. In the Consolidated ES noise assessment, outdoor measurement locations that would give results that are representative of the ambient sound and residual sound at the measurement locations were chosen. A series of daytime and night-time noise measurements were made on several separate occasions. The operational noise from the overhead lines and substation were then compared with these levels.

5. BS4142:2014 would now require details as to weather, wind speed and temperature when the measurements were taken. This was not required under BS4142:1997 but the extensive monitoring over the daytime and night-time allowed for varying weather conditions and the results are valid.

6. It is considered that the predicted noise impact should be taken to be near to an assessed dwelling rather than at the extent of any garden. This would be in line with other standards such as ETSU-97-R Good Practice Guide dealing with the assessment of noise from wind turbines. This suggests that where possible, measurements should be made in the vicinity of the dwelling in an area frequently used for rest and relaxation. This is a flexible definition and the way people use their garden areas varies widely.

7. For the background sound level BS4142:2014 would suggest that the objective is not simply to ascertain the lowest measured background sound level, but rather to quantify what is typical during the particular time periods.

8. Since the intention is to determine the background sound level in the absence of the specific sound that is under consideration, it is necessary to understand that the background sound can in some circumstances legitimately include industrial or commercial sounds that are present as separate to the specific sound.

9. In practice, there is no 'single' background sound level as this is a fluctuating parameter. However the background sound level used for the assessment should be representative of the period being assessed. Section 8.1.4 Note 1 BS4142:2014 states:

> *"A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value."*

10. Section 9.2 of the BS4142:2014 allows for corrections to the specific sound level if it is tonal, impulsive or another characteristic occurs.

11. Like the 1997 edition the standard provides a method for comparing the specific sound levels so as to account for acoustic features that are present at the assessment location. The approach in the 1997 edition was purely subjective and allowed a +5 dB correction irrespective of how prominent the feature was or whether there was one feature only or a combination of tones, impulses or other features irregular enough to attract attention.

12. The 2014 edition provides for scale corrections up to +6dB for tones and up to +9dB for impulses depending upon the prominence of the tones or impulses as well as +3dB correction for other sound characteristics that are neither tonal nor impulsive and/or intermittent features when the sound has identifiable on/off conditions.

13. The 2014 edition no longer assesses the likelihood of complaints. Instead it can be used to assess adverse impacts. This change was introduced because the likelihood of complaints is not a particularly appropriate benchmark, especially when it is used in a planning context and also it aligns the standard more easily with the language and benchmarks that are suitable for the assessment of sound at the planning stage for new proposed development.

14. It continues to use the difference between the rating level and background sound level although it also introduces the requirement to consider the context and states that:

- Typically the greater this difference the greater the adverse impact;
- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5dB is likely to be an indication of an adverse impact depending on the context; and
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of a specific sound having a low impact depending on context.

15. The context includes consideration of pertinent factors such as:

- The absolute sound level;
- The character and level of the residual sound compared to the character and level of the specific sound; and
- The sensitivity of the receptor and other dwellings or other premises used for residential purposes which already incorporate design measures that secure good internal and/or outdoor acoustic conditions.

16. It is considered that operational noise from the overhead lines or substation is characterised by a low frequency hum with occasional short bursts of corona discharge or aeolian noise in certain weather conditions.

17. Operational noise may be present. This may include temporary noise discharges, such as Corona Noise or Aeolian Noise and continuous noise or humming from the conductors.

18. Corona noise is occasionally found on transmission lines where higher voltages exist. Most modern transmission lines and substations are designed to reduce the magnitude of the electric field surrounding the line conductors below the air breakdown value. Occasionally a small sharp point can be found on a line or on nearby hardware that will result in a corona discharge. Such discharges are often more active during the increased humidity conditions provided by fog or light rain. Water drops impinging or collecting on the conductors produce a large number of corona discharges, each of them creating a burst of noise. In dry conditions, the conductors usually operate below the corona inception level, and less corona sources are present.

19. Corona noise comprises two sound components: one is irregular (random noise) sound, and the other is the pure sound (corona hum noise) of buzzing. The random sound has a wide frequency band because the impulsive sounds caused by corona discharge overlap randomly. The corona hum noise results from the excitation of ion groups, which was generated from corona discharge, caused by the electric field surrounding the conductors. The predominant frequency of the corona hum noise is double the commercial frequency (100 Hz in this instance).

20. The level of operational noise from overhead lines will vary depending upon the environmental conditions, the locality and a number of other factors including the distance to ground and voltage. The noise experienced from this discharge is typically a short burst of random 'crackling'. Corona discharge typically occurs where a sharp point or edge is present, either on the conductor or the pylon coupling.

21. Due to these factors an exact level of impact cannot be predicted. It may be the case, that under certain circumstances, the background level may be exceeded by more than +10 dB. However due to the unpredictability of corona noise derived from overhead lines and very short limited duration of such discharges (typically peak levels of a duration of less than 1 second) the overall impact when considered over an hour (ref BS4142:2014 daytime reference time period) or 15 minutes (night-time reference period) will be minimal.

22. Due to the high voltages associated with 400 kV line routes continuous operational noise can be present. A noise survey at an existing operational 400 kV overhead line route has been conducted. The line route that was surveyed is the Oldstreet – Woodland route operated by ESB. This line runs to the west of the Woodland Substation on a route south of the town of Summerhill, Co. Meath. The measurements were conducted at a range of distances from the pylon. In each case the pylon noise was audible but not dominant over the ambient noise levels.

23. The measurement results are presented in terms of 'dB L_{Aeq}' which is representative of an average of the energy associated with the noise at a location over a given time interval. The levels in terms of 'dB L_{A90}' are also presented and represent the level exceeded for 90% of the given time interval. This is often considered as representative of the 'background' noise level at a location. The results are presented in Table 11.1 below.

Table 11.1: Measured Power Line Noise Levels

Measurement Position	Measured Noise Level	
	dB LAeq	dB LA90
At base of pylon, Bogganstown. 5mins	45.3	45.1
At base of pylon, Newtownrathganley, 5mins	44.4	44.0
Underneath Power lines, Newtownrathganley, Lowest Point, 5mins,	39.8	39.5

24. These measurements can be used to estimate the possible noise levels at varying distances from the proposed line and towers.

25. Based on a noise level of 45 dB L_{Aeq} at the base of a pylon, the noise levels at varying distances, using standard formulae and a source height of 20m have been calculated and are presented in Table 11.2 below.

26. The 45 dB L_{Aeq} noise level at the base of a pylon is used here to illustrate a worst-case scenario. The towers will be spread along the route at a distance ranging from 300 m to 500m. Many receptors will

be closer to the line route itself than a pylon tower. Thus the noise emission levels from the towers, which are higher than the line route, have been employed along the entire route to present a worst case scenario.

Table 11.2: Predicted noise levels at varying distances from pylon base.

Distance	At base of pylon	20m	40m	60m	80m	100m	150m
Level dB	45	42	38	35	33	31	29

11.3 Guidelines on Internal Environments (Based on BS8233:2014)

27. BS8233 Section 7.6.1 contains guidelines for residential properties within a noise level range such that the lower value is 'good' and the upper value is 'reasonable'. The target criteria for living rooms recognise that these room may be used for resting or sleeping, and there is no distinction between day and night-time use. The criteria presented are:

- Living Rooms = 30-40 dB L_{Aeq}
- Bedrooms = 30-35 dB L_{Aeq}

28. Considering fair weather and an external level of 35-38 dB at any close noise sensitive property as a worst-case scenario (this is the predicted value for a 60 metres distance from the line route and within the 'fair weather range'), and 15 dB attenuation due to an open window (as per the WHO Guidelines), the predicted internal noise level would be circa 20-23 dB. This is below the BS 8233 guidelines levels of between 30-35 dB for bedrooms and below 30-40 dB for Living Rooms.

29. 'Aeolian noise' also known as turbulent wind noise may be created due to high wind speeds affecting the pylons and conductors. The amount of Aeolian noise is directly linked to wind speed and direction. This type of noise impact is normally not considered as significant as the ambient noise levels are also higher (affected by occurrences such as wind in trees) therefore minimising any impact.

30. The Standard recognises the difficulty or uncertainty in dealing with a site where there are many complex variable sound sources and the residual environment varies. It states the following:

10 Uncertainty

10.1 General

Consider the level of uncertainty in the data and associated calculations. Where the level of uncertainty could affect the conclusion, take reasonably practicable steps to reduce the level of uncertainty. Report the level and potential effects of uncertainty.

10.2 Uncertainty of measured values

Report the reasoning for the selected measurement method, together with steps taken to reduce measurement uncertainty.

NOTE The level of uncertainty associated with a measurement of sound level depends upon a number of factors, including:

a) the complexity of the sound source and the level of variability in sound emission from the source;

b) the complexity and level of variability of the residual acoustic environment;

c) the level of residual sound in the presence of the specific sound at the measurement location;

d) the location(s) selected for taking the measurements;

e) the distance between sources of sound and the measurement location and intervening ground conditions;

f) the number of measurements taken;

g) the measurement time intervals;

h) the range of times when the measurements have been taken;

i) the range of suitable weather conditions during which measurements have been taken;

j) the measurement method and variability between different practitioners in the way the method is applied;

k) the level of rounding of each measurement recorded; and

l) the instrumentation used.

An appreciation of the uncertainties in the measurement is likely to lead to a better understanding of the measurement, its potential variability and any implications in the reported findings of the assessment. In such instances, where the level of uncertainty is too great, it might be necessary to repeat measurements or to take other steps to obtain the desired confidence in the results.

11.4 Conclusions

31. It is considered that the noise assessment presented in the Consolidated ES has used low background noise levels and residual noise levels that take sufficient account of the character and variability of the area.

32. The BS4142:2014 standard adds the limitations and explanations which are intended to further clarify its application. The determination of noise amounting to a nuisance is beyond the scope of this British Standard.

33. The 2014 Edition no longer assesses the likelihood of complaints. Instead it can be used to assess adverse impacts.

34. The new edition of the standard makes it explicit that the purpose of any assessment is to consider the likely significance of the impact of industrial or commercial sound at noise sensitive receptors and this depends upon the context in which the sound is experienced. It should be clear that this must involve an understanding of uncertainty, both in terms of the significance of the sound, including what is considered to be a suitable rating penalty where appropriate and the effect that the context may have on the potential significance of the sound.

35. The inference is that other relevant factors should be taken into account as part of a wider assessment. The key change is not that the new standard has introduced context as a new concept, but rather that it now explicitly recognises the context to be considered part of the assessment.

36. It is concluded that the Consolidated ES generally accords with the revised standards. While the background noise levels are low in the study area, a precautionary assessment has been undertaken. The assessment remains that the noise impacts of the proposed Tyrone – Cavan Interconnector will be below the recommended levels and targets set by the WHO and the British Standards BS8233 and BS4142 and are thus within acceptable limits in Northern Ireland. Therefore there will be no significant noise effects.

Chapter 12 Erratum



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12 Erratum

The following typographical errors have been noted in the published Consolidated ES (the amended text has been *highlighted*):

Section	Text	Comment
NTS – Section 6.4 EMF, paragraph 14, Page 28	"7.7kV/m" and "47µT" should read "7.*9*kV/m" and "47.*9*µT". Both of these levels are within ICNIRP guidelines and comply with UK Government policy.	Typographical error. Corresponding text in the Consolidated ES, Chapter 7, unaffected.
NTS– Section 6.10 Landscape, Paragraph 252	"21 viewpoints" should read "*22* viewpoints". The proceeding list of viewpoints was also updated.	Typographical error. Corresponding text in Chapter 13 is unaffected.
NTS – Section 6.10 Landscape, Paragraph 256 and 257	Number of dwellings corrected to match Chapter 13 text.	Typographical error
Consolidated ES, Chapter 3, paragraph 1, page 40	The Planning (Northern Ireland) Order 1991 (as amended) sets out the Department of the *Environment* or DOE") functions in planning.	
Consolidated ES, Chapter 3, paragraph 40, page 47	Paragraphs *28*-33 above are applicable to Policy PSU 8	
Consolidated ES, Chapter 3, paragraph 105, page 59	and Conservation (pages 72-7*9*)	
Consolidated ES, Chapter 4, paragraph 36, page 65	"(See ECOFYS *2008*, as discussed in section *4.2.5.2* and PB Power 2009, as discussed in section *4.2.4.9*)."	Typographical error.
Consolidated ES, Chapter 4, paragraph 53, page 67	Multiple references to Sections 2.9 and 2.10 should read *Chapter 2*.	Typographical error.
Consolidated ES, Chapter 5, paragraph 19, page 119	"The area of the substation to the outer boundary fence will be *2.25*ha (22,500m^2)."	Typographical error.
Consolidated ES, Chapter 5, paragraph 209, page 150	"The site of the substation will generate approximately *261,130m^3* of excavated material. Of this there is the potential to reuse approximately *167,130m^3* (*64%*) within the redline application boundary of the substation site. The remaining approximately 94,000m^3 (*36%*) will be disposed of to landfill."	Figures were rounded down in formatting. Changed to actual estimated values (see Chapter 5, paragraph 24, page 119 for further detail).
Consolidated ES, Chapter 9, paragraph 14, page 254	And *"The Waste and Contaminated Land Order (Northern Ireland) 1997 and Model Procedures for the Management of Land Contamination: CLR 11 2004"*	Typographical error.

Section	Text	Comment
Consolidated ES, Chapter 9, paragraph 87, page 271	*"The assessment has been based broadly on the guidance provided in CLR 11 'Model Procedures for the Management of Land Contamination'."*	Typographical error.
Consolidated ES, Chapter 11, paragraph 73, page 382	Reference to Table 11.3 should read *Table 11.2*.	Typographical error.
Consolidated ES, Chapter 11, paragraph 95, page 385	Reference to Illustration 11B should read Illustration *11.2.*	Typographical error.
Consolidated ES, Chapter 11, paragraph 103, page 387	Reference to Table 11.4 should read Table 11.*2.*	Typographical error.
Consolidated ES, Chapter 12, paragraph 25, page 394	"Grade C" should read "Grade *B*"	Typographical error.
Consolidated ES, Chapter 12, Table 12.5, page 396	"17 archaeological objects" should read "*73* archaeological objects".	Typographical error.
Consolidated ES, Chapter 12, Table 12.5, page 409 and Table 12.6, page 412	Mullyloughan House (35): "Moderate value" should read "*High* value" Rath (68): "Moderate value" should read "*High* value"	Values were incorrect in table and have been correct to reflect the correct chapter text.
Consolidated ES, Chapter 13, paragraph 383, page 463	"impact for this viewpoint location" should read "impact for this character area"	Typographical error.
Consolidated ES, Chapter 13, paragraph 429, page 470	"427 residential properties" should read "42*3* residential *dwellings*"	Typographical error.
Consolidated ES, Chapter 13, paragraph 476, page 480	*A total of 450 dwellings were assessed that lie within 500m of the proposed overhead line route. Twenty seven of these dwellings were found to be derelict or farm buildings and were therefore excluded from the assessment.* Of the remaining 42*3* dwellings in summer 15 years after opening, there will be: • *18* dwellings that experience a major adverse impact; • *199* dwellings that experience a moderate - major adverse impact; • *105* dwellings that experience a moderate adverse impact; • *29* dwellings that experience a minor - moderate adverse impact; • 64 dwellings that experience a minor adverse impact; and, • *8* dwellings that experience no effect.	Typographical error and clarification provided of assessed numbers of dwellings.
Consolidated ES, Chapter 13, Table 13.9, page 519	B106 - Operation Y1 Impact: *Moderate* Operation Y15 Magnitude: *Low - Medium*	Typographical error. Values were incorrectly entered into table and have been corrected to reflect the correct chapter text.

Section	Text	Comment
Consolidated ES, Chapter 14, paragraph 9, page 528	"Five groups" should read "*six* groups"	Typographical error.
Consolidated ES, Chapter 14, paragraphs 83 and 84, page 556	References to Table 14.11 should read Table 14.*10.*	Typographical error.