

Moyle Interconnector Limited
Interconnector Capacity Calculation

July 2017



Executive Summary

Moyle Interconnector Limited (MIL) owns and operates the submarine cables between converter stations at Ballycronan More in Islandmagee, County Antrim and Auchencrosh in Ayrshire that link the electricity transmission systems of Northern Ireland and Scotland. The cable and key components of the link have an engineering capacity of 500MW in each direction. However, limits applied by the Transmission System Operators at either end of the link mean that, at present, the full Moyle Interconnector engineering capacity cannot be made available to the market for flows between the BETTA and SEM markets.

MIL, in conjunction with National Grid Electricity Transmission (NGET), Scottish Power Transmission (SPT), the System Operator for Northern Ireland (SONI) and NIE, the Northern Ireland transmission network owner, has prepared this statement to outline how available capacity on both the GB National Electricity Transmission System and the Northern Ireland Electricity Transmission System is assessed for the physical transfer of power between Northern Ireland and Scotland using the Moyle Interconnector.

This document sets out the work undertaken to determine the levels of capacity that can be made available to the market from 10 November 2017, together with future work to be undertaken by all concerned parties to investigate how and when the maximum capacity can be made available. Section A (referring to the GB network) has been prepared by NGET while section B (referring to the NI network) has been prepared by SONI.

Contracted capacity available to Moyle in the direction West to East (flowing into GB) varies according to other connections on the network and network reinforcements in Scotland, but is additionally constrained by the NI network. Proposals to release additional capacity in that direction are based on near time assessments of network conditions. Capacity available to Moyle in the direction East to West (flowing into NI) is constrained by both GB and NI networks.

National Grid, as the GB System Operator (GBSO), wishes to state that the “NGET Processes for Assessing Capacity at Two Day Ahead and Day Ahead”, as described in Appendices 2 and 3 of this document, are dependent upon further clarification and detail by the System Operator Northern Ireland (SONI) of their own process(es) and the interactions between both GBSO and SONI. Therefore, the GBSO processes proposed in this document may be subject to further revision.

This document is presented for consultation and the content of this document is subject to approval by the regulatory authorities NIAUR and Ofgem.

Table 1: Summary of capacity available to Moyle in the GB network from 10 November 2017

Direction	Dates	Firm contracted capacity (MW)	Additional capacity potentially available (MW) ¹	Potential total capacity available (MW)
West to East	10 November 2017 to 30 November 2019	80	420	500
	01 December 2019 to 31 May 2020	307	193	500
	01 June 2020 to 31 October 2021	250	250	500
	01 November 2021 to 31 March 2022	160	340	500
	01 April 2022 onwards	500	0	500
East to West	November to March each year	450	-	450

¹ Through capacity release in the GB network, using the two day ahead process (Appendix 3) until I-SEM Go Live and the one day ahead process (Appendix 2) from I-SEM Go Live.

Table 2: Summary of capacity available to Moyle in the NI network from 10 November 2017

Direction	Dates	Capacity available (MW)
West to East	All year	295
East to West	April – October	410
	November - March	450

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Introduction

Moyle Interconnector Limited (MIL) owns and operates the submarine cables between converter stations at Ballycronan More in Islandmagee, County Antrim and Auchencrosh in Ayrshire that link the electricity transmission systems of Northern Ireland and Scotland. The cable and key components of the link have an engineering capacity of 500MW in each direction. However, limits applied by the Transmission System Operators (“TSOs”) at either end of the link mean that, at present, the full Moyle Interconnector engineering capacity cannot be made available to the market for flows between the BETTA and SEM markets.

MIL, in conjunction with National Grid Electricity Transmission (NGET), Scottish Power Transmission (SPT), the System Operator for Northern Ireland (SONI) and NIE, the Northern Ireland transmission network owner, has prepared this statement to outline how available capacity on both the GB National Electricity Transmission System and the Northern Ireland Electricity Transmission System is assessed for the physical transfer of power between Northern Ireland and Scotland using the Moyle Interconnector.

This capacity calculation is a requirement of Article 15(2) of Regulation EC 714/2009 on conditions for access to the network for cross-border exchanges in electricity which states that “*a general scheme for the calculation of total transfer capacity and the transmission reliability margin based on the electrical and physical features of the network*” shall be published (subject to the approval of the regulatory authorities).

Furthermore, it is a requirement of Article 16(3) of the same Regulation that “*the maximum capacity of the interconnections and / or the transmission networks affecting cross-border flows shall be made available to market participants, complying with safety standards of secure network operation*”.

This document sets out the work undertaken to determine the levels of capacity that can be made available to the market from 10 November 2017, together with future work to be undertaken by all concerned parties to investigate how and when the maximum capacity can be made available. Section A (referring to the GB network) has been prepared by NGET while section B (referring to the NI network) has been prepared by SONI.

This document will be updated as the capacity available to the interconnector changes.

A Great Britain Network

A1. General Scheme for Assessing Transfer Capacity

Under the current GB electricity framework, interconnector operators are still signatories to the Connection and Use of System Code (CUSC), part of which sets out the process which has to be followed by an applicant for connection to the National Electricity Transmission System (“the GB system”) or for existing Transmission Entry Capacity (“capacity”) to be modified. These arrangements are such that, upon receipt of an application by an interconnector developer to connect to, or to modify their existing connection to, the system, NGET as National Electricity Transmission System Operator (“system operator”) is obligated by its transmission licence to make a formal offer to the applicant within 3 months of the application being deemed to be ‘competent’².

When considering applications for capacity on the system, NGET has to consider whether these connections or modifications require any network reinforcement. If action is required, further analysis is needed to establish the economic and efficient level of reinforcement necessary.

The cost of any such reinforcement is usually recovered through Transmission Network Use of System (TNUoS) charges (“network charges”). These charges are not levied on interconnectors as costs relating to cross-border flows are reflected through the Inter-TSO Compensation (ITC) mechanism in which any TSOs hosting flows are compensated by the TSOs at the origin and destination of the flow³.

Assets solely required to connect an individual user to the system which are not, and would not normally be, used by any other connected party (i.e. single user assets) are classed as ‘Transmission Connection Assets’. All connecting parties, including interconnector operators are required to pay for these ‘Transmission Connection Assets’ via a one off charge that is not passed through to interconnector users. Alternatively, they also have the option to undertake the construction, financing and ongoing maintenance of these connection assets themselves providing that this does not have a detrimental effect on system integrity, security and safety.

In order to provide offers for new connection applications (including by interconnector operators), it is also necessary to determine whether any local reinforcement works are required. This requirement must be assessed in accordance with principles set out in both Chapter 2 (Generation Connection Criteria) and Chapter 3 (Demand Connection Criteria) of the National Electricity Transmission System Security and Quality of Supply Standards (“security standards”)⁴. The criteria presented in the security standards represent the minimum requirements for the planning, development and operation of the system under Condition C17 of the Electricity Transmission Licence⁵.

In general, the security standards set out that, prior to any fault on the system, there should not be any:

- equipment loadings exceeding the pre-fault rating;
- voltages outside the pre-fault planning voltage limits; or
- system instability.

The corresponding standards required following certain secured faults⁶ on the system (under both intact and transmission outage conditions) are also set out. These calculations are made assuming background conditions whereby the interconnector is either at maximum import (Generation Connection criteria) or maximum export (Demand Connection criteria).

² In order for an application to be deemed ‘competent’, NGET must have received a completed application form, the relevant cleared application fee and the appropriate technical data.

³ The NGET proposal (ECM-026) to remove the obligation on interconnectors to pay Transmission Network Use of System (TNUoS) charges was not vetoed by Ofgem and came into effect from April 2010. Link to decision letter from Ofgem: <http://www.nationalgrid.com/NR/rdonlyres/46289F11-D100-4BC8-A791-6DEF891CC047/43450/ECM26decisionletterpublished041010.pdf>

⁴ For more information see <http://www.nationalgrid.com/uk/Electricity/Codes/gbsqsscode/>

⁵ Under specific circumstances, licensees have the ability to apply to Ofgem for derogation from condition C17 in respect of these requirements.

⁶ Transmission faults that the system is designed to be able to withstand with no loss of supply.

In addition to any local reinforcements, the connection or modification application must also be assessed against the principles set out in Chapter 4 of the security standards (Design of the Main Interconnected Transmission System). This assessment is similar to those carried out under Chapters 2 and 3 but involves transfer flows across all of the boundaries on the wider system rather than being limited to the local system around the connection point.

A2. Assessing Transfer Capacity in the case of the Moyle Interconnector

The rationale outlined in Section 1 is general to all interconnector applications under the current CUSC process. However, in the case of the application to increase the amount of capacity available to the Moyle Interconnector, there were a number of non-standard and legacy aspects which required consideration.

The Moyle Interconnector originally consisted of a 63km undersea cable between the converter stations in Northern Ireland and Scotland and a 64km overhead line from Auchencrosh (the converter station on the Scottish coast) to the existing Scottish system at Coylton (see Diagram 1). The 64km overhead line is a single circuit connection, as opted for by MIL at the time they applied to SPT for a connection, in preference to the standard double circuit normally required under the security standards. This was a decision taken by MIL in the context of extremely difficult planning consent and also in the expectation that the line would be for the sole purpose of MIL and not open access as occurred with the introduction of BETTA. Under the transitional arrangements at BETTA⁷, this right to deviate from the standard connection was 'grandfathered' into the GB agreements by way of a 'Variation to Connection Design' under Chapter 2 of the security standards. Under the regime in place in Scotland at the time of its original connection application, the cost of the over-land section of the Moyle Interconnector was charged in full to MIL. However, as part of the transition to BETTA, this section of the interconnector (the Auchencrosh – Coylton circuit) was assimilated (following a connection charge rebate to MIL) into the wider transmission system.

The physical capability of the Moyle Interconnector is 500MW in each direction and it has a Connection Entry Capacity (CEC) of 500MW. However, MIL originally only applied for a Transmission Entry Capacity (TEC) of 80MW in the direction Northern Ireland to GB due primarily to the fact that anticipated flows for their customers were expected to be in the opposite direction (i.e. GB to Northern Ireland) for the majority of the time. Subsequent to this original connection offer being signed by MIL, several wind farms have now connected to the Auchencrosh - Coylton circuit with the effect that the amount of additional local capacity in the area available to all system users, including the Moyle Interconnector, is significantly reduced.

The obligation on MIL to pay network charges based on their level of TEC meant that they had a financial incentive to apply only for capacity which would be valued by their customers. However due to the expectation for increased demand for flows west to east driven by the penetration of renewables in the SEM, MIL made an application early 2010 for what firm capacity remained in the local network. This application went 'interactive'⁸ and in April 2010 Kilgallioch wind farm accepted an offer for all remaining available firm capacity. Subsequent removal of the obligation to pay network charges effectively removed this financial incentive for MIL to limit its TEC and, in conjunction with the requirements of the European 3rd Package legislation⁹, led to the decision by MIL to make a second formal 'Modification Application' to increase their TEC to as near to 500MW in both directions, up to the point at which system reinforcement is required. The reason for this caveat being included was that any reinforcements would take a number of years to complete¹⁰ whereas capacity available before the requirement for reinforcement could be provided immediately. This resulted in increased TEC being made available on a temporary basis until 9th November 2017 with the commitment that all parties NGET, SPT, SONI and MIL address how the full capacity of the interconnector could be made available to the market in compliance with Regulation 714/2009¹¹ from 10th November 2017. Cost benefit studies were executed by NGET and SONI through 2013 which appeared to support network reinforcements being undertaken to support additional flows on Moyle but such reinforcements have not been progressed.

⁷ BETTA stands for 'British Electricity Transmission and Trading Arrangements' and took place in 2005. It was at this point that the New Electricity Trading Arrangements (NETA) introduced into England and Wales in 2001 to liberalise the electricity market were extended to Scotland.

⁸ i.e. two simultaneous offers for the same capacity were issued on a first come first served basis

⁹ Article 16(3) of Regulation (EC) No 714/2009

¹⁰ The treatment of future system reinforcement is considered in Section 4.

¹¹ Article 16(3) of Regulation (EC) No 714/2009

In November 2015 MIL submitted a further 'Modification Application' to NGET seeking the full 500MW capacity in both directions.

Therefore when considering each 'Modification Application', the maximum additional transfer capacity available to MIL was taken by NGET to be the amount of capacity that the existing system could deliver (taking into account other connected and contracted parties in the relevant area) before any local reinforcements were required. These were based on the 'Enabling Works' outlined in Chapter 13 of the CUSC¹² which, at a minimum, include those reinforcements required to meet the following criteria:

1. achieve compliance with the "Pre-fault Criteria" set out in Chapter 2 of the security standards;
2. achieve compliance with the "Limits to Loss of Power Infeed Risks" set out in Chapter 2 of the security standards;
3. enable [NGET] to operate the National Electricity Transmission System in a safe manner;
4. resolve any fault level issues associated with the connection and/or use of system by the Connect and Manage Power Station;
5. comply with the minimum technical, design and operational criteria and performance requirements under the Grid Code;
6. meet other statutory obligations including but not limited to obligations under any Nuclear Site Licence Provisions Agreement; and
7. avoid any adverse impact on other Users.

The 'Variation to Connection Design' granted to MIL at BETTA commencement is deemed to satisfy the other relevant requirements under Chapter 2 of the security standards provided that certain conditions (set out in paragraphs 2.16.1 to 2.16.3) are met. These state that the 'Variation to Connection Design' must not, other than in respect of the generation customer requesting it (i.e. MIL), immediately or in the foreseeable future:

- reduce the security of the wider system to below the minimum planning criteria specified in *Section 4*¹³; or
- result in additional investment or operational costs to any particular customer or overall, or a reduction in the security and quality of supply of the affected customers' connections to below the planning criteria in *this section* or *Section 3*, unless specific agreements are reached with affected customers; or
- compromise any transmission licensee's ability to meet other statutory obligations or licence obligations.

Taking this into account, the capacity available (over and above MIL's contracted position) to the Moyle interconnector at any given period will be determined as per the agreed processes illustrated in Appendices 2 and 3.

The process allowing a CUSC user to modify their capacity can be found in Appendix 1. The detail regarding the technical limitations of the local network can be found in section 3, along with the contracted allowable import from NI to GB, based on an SQSS and Connect and Manage assessment. The principles of Connect and Manage with regard to Enabling Works can be found in section 13 of the CUSC.

The processes illustrated in Appendices 2 and 3 have been derived by NGET, as the GB System Operator, in conjunction with MIL, SONI and SPT. The underlying driver behind the consultation of these proposed processes is to be able to optimise the capacity on the GB system that can be utilised by MIL, over and above the contracted position highlighted in section 3. As the majority of connected and contracted generation in the local area is Wind, it is anticipated that there will be times whereby

¹² For more information on the CUSC, see <http://www.nationalgrid.com/uk/Electricity/Codes/systemcode/contracts/>

¹³ It was determined, following transmission studies, that no wider reinforcements were triggered beyond those already identified to connect other new generation in the current generation background.

additional import (NI to GB) capacity can be granted to MIL, on the basis of the GB System Operator providing an optimised network under its' obligation to deliver economic and efficient system operation.

The processes have been designed with a view to optimising network capacity on the GB System, in accordance with the anticipated requirements of methodologies implementing the Capacity Allocation and Congestion Management Regulation (CACM¹⁴). The proposed processes (as illustrated in Appendices 2 and 3) have been designed as an interim measure in lieu of any agreed methodology as a result of the Capacity Allocation and Congestion Management Regulation. It should be recognised that the outcome of the CACM methodologies will supersede this interim arrangement¹⁵,

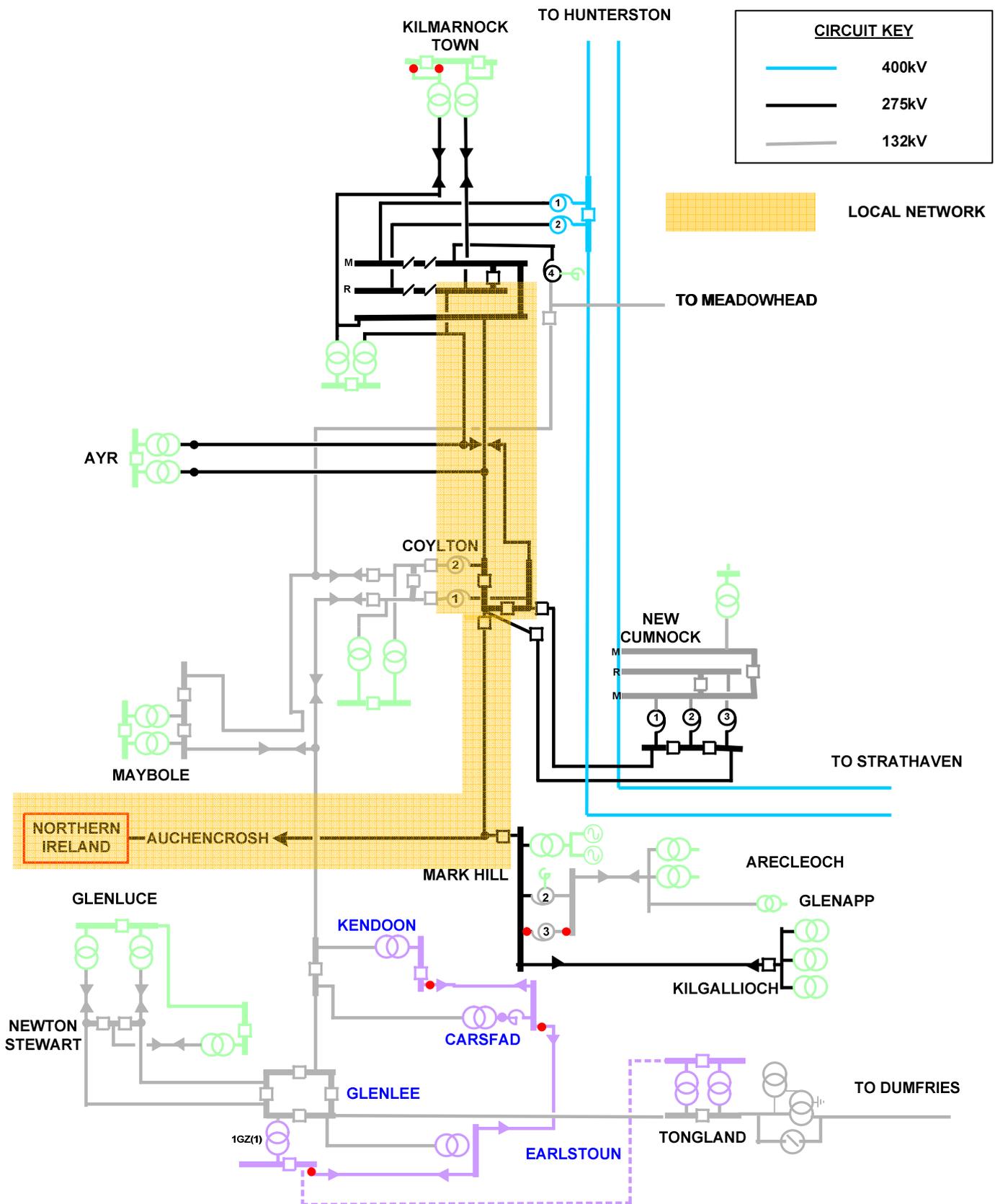
The Capacity Allocation and Congestion Management guideline sets out the method of allocating capacity at the day-ahead and intra-day timescales, across the European Market. The main driver behind the implementation of CACM is aimed at increasing efficient use of interconnection across the European market, hence delivering benefits to end consumers. At the time of writing, the capacity calculation 'go-live' date is planned for quarter 1, 2019. The details of the methodology to be implemented will be subject to consultation and regulatory approval.

MIL existing trading requirements in the SEM require National Grid and SONI to provide capacity information at 2 days ahead (Appendix 3). Following the introduction of ISEM trading arrangements, expected May 2018, MIL will be able to accept data at 1 day ahead and a transition to the Day Ahead Process (Appendix 2) is expected to take place with immediate effect.

¹⁴ [Commission Regulation 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management](#)

¹⁵ Only with respect to the capacity calculation undertaken up to April 2022, after which Moyle has accepted an offer of 500MW commercially firm TEC

Figure 1: Local Transmission Network in South West Scotland



A3. Technical Assessment Undertaken by SPT

The following section sets out the information used to inform the agreed processes, as defined in Appendices 2 and 3.

Northern Ireland to Scotland Capacity

NGET, as the GB System Operator, has derived the processes described in Appendices 2 and 3 based on MIL's current contracted position (as highlighted later in this section) and consideration of the following information provided by SPT:

Table A1: Wind generation holding TEC on the Auchencrosh – Coylton and Coylton – Kilmarnock South lines (Local Network in Figure A1)

Generator	Licensee	Type	Connection Date	Status	TEC
Mark Hill	SPT	Wind		Connected	56
Arcleoch	SPT	Wind		Connected	114
Glen App	SPT	Wind		Connected	32
Kilgallioch	SPT	Wind		Connected	274
Tralorg	SPT	Wind	30/06/2018	Consented	20
Stranoch	SPT	Wind	30/09/2022	Consented	72
Chimorie	SPT	Wind	30/09/2022	Contracted	80
Total					648

The wider system generation background was taken from the Construction Planning Assumptions as were issued by NGET on the 19th August 2016.

To determine the maximum contractual capacity that was available for the Moyle Interconnector, SPT assessed the local circuits on a seasonal basis (i.e. using the individual summer, spring-autumn and winter seasonal ratings). The GB System Operator will then use the agreed processes in Appendices 2 and 3 to allocate capacity over and above the current contracted position for MIL.

The determining technical factor in the contracted position was the single 275kV circuit between Auchencrosh and Coylton (see diagram 1) and the double 275kV circuit between Coylton and Kilmarnock South. The continuous overhead line ratings for these circuits are provided in table A2. Consistent with the requirements of the security standards, in determining the available capacity, SPT assessed background conditions of 0.95pu voltage of the 275kV system pre-fault, with local generation on, at maximum output, and with a windfarm power factor of 0.95. The available contracted capacity was established on the basis of the net reactive power transfer from Moyle Interconnector being not in excess of 60MVAR.

Table A2: Auchencrosh – Coylton Overhead line ratings

	Winter (MVA)	Spring/Autumn (MVA)	Summer (MVA)
Pre-Fault Continuous	930	915	890

In summary, the assessment determined that, taking account of the contracted generation background and the system capability between Auchencrosh, Coylton and Kilmarnock South, the maximum contractual capacity on the system available to the Moyle Interconnector is given in stages until 1st April 2022. Additional capacity over and above these values will be allocated by the GB System Operator in accordance with the defined, agreed processes in Appendices 2 and 3.

Table A3: Contracted TEC held by Moyle Interconnector, with optimised capacity potentially available through the processes described in appendices 2 and 3

Dates	Level of TEC not subject to the Interim Restrictions on Availability (contracted capacity) (MW)	Level of proposed optimised capacity potentially available (MW)	Potential total capacity available (MW)	Commentary
10 November 2017 to 30 November 2019	80	420	500	Contracted capacity reduced due to switchgear limitation at Kilmarnock South 275kV substation.
Completion Date (01 December 2019) to 31 May 2020	307	193	500	Post completion of Kilmarnock South works, additional Contracted capacity allocated up to the full pre-fault seasonal rating of the YY route.
01 June 2020 to 31 October 2021	250	250	500	Based on the contracted position, the limiting factor becomes the XY double circuit between Coynton and Kilmarnock South, hence reduction in Contracted capacity.
01 November 2021 to 31 March 2022	160	340	500	More contracted generation connects ahead of Moyle.
Interim Restrictions Release Date (01 April 2022)	500	0	500	Commercially Firm contract offered based on wider Dumfries and Galloway non-build commercial arrangements.

Scotland to Northern Ireland Capacity

Historically, the Scotland to Northern Ireland capacity has been restricted to 450MW due to the requirement to meet the voltage step change criteria contained in the security standards. With the Moyle Interconnector exporting power from Scotland to Northern Ireland, the demand in the Kilmarnock South transmission group increases. With high export from Scotland to Northern Ireland and with low generation in the group, a secured event on the wider south-west Scottish network can cause step changes approaching the 12% limit specified in Chapter 6 of the security standards. Even with the connection of additional wind generation in the group, and additional reactive equipment at Moyle, this scenario continues to exist and therefore the technical restriction of 450MW remains.

A4. Future Work and Longer Term Investment – GB Network

Sections A1 – A3 of this document outline the steps that should be followed to calculate any capacity available (over and above MIL's firm contracted position) on the GB system that can be allocated to MIL. As defined in these sections, a number of factors have been considered when allowing additional capacity to be allocated in accordance with the current relevant legislation and agreed operating procedures. The approach that has been proposed should be viewed as a pre-cursor to the anticipated Capacity Allocation and Congestion Management framework, in order to provide an optimised capacity figure to MIL.

National Grid, in its role as GB System Operator (GBSO), is responsible in ensuring that the most economic and efficient solution is chosen with regard to network investment or operational measures. There are currently a number of processes in place that allow the GBSO to assess the economic benefit to the GB end consumer of each presented option. The first of these processes is known as the Network Options Assessment (NOA). The role of NOA is to use information from the Future Energy Scenarios (FES), coupled with reinforcement options provided by the respective Transmission Owners, to justify the most economical solution for a particular needs case. As a result of this process, network investment decisions are analysed on a yearly basis and can receive a number of possible outcomes. The main objective of NOA is to ensure that investment decisions are made in a timely manner whilst not exposing the GB Consumer to unnecessary system balancing costs.

Further to the Network Options Assessment process, the GBSO also operates a further set of analysis known as Strategic Wider Works. Once a proposed reinforcement reaches a particular cost threshold, there is an obligation for the GBSO to provide reasoning and justification that the proposed reinforcement is the most economical solution to meet the Security and Quality of Supply Standards (SQSS). The cost threshold differs, depending on the Transmission Owner area, however; the methodology for assessment is the same.

The methodology employed by the GBSO for both the NOA and SWW processes is known as Cost Benefit Analysis (CBA). The underlying principle of the CBA methodology is to assess operational costs against the build cost of a particular reinforcement, across the expected lifetime of the asset.

Through both the NOA and SWW¹⁶ processes, future network investment is continually reassessed against an ever changing energy landscape, always ensuring that the most suitable option is chosen for GB consumers.

In order for any reinforcement to be justified on a technical and economic basis, it would have to be demonstrated that the cost of the reinforcement would be less than the cost of resolving congestion by system operator balancing over the life of the new assets involved. This would involve a detailed study into likely future demand and generation trends, as well as other planned transmission projects in the All Island market and GB market.

In light of requirements set out in the European 3rd Package legislation relating to cooperation and coordination between TSOs, this work should involve developing a consolidated Eirgrid¹⁷, SONI and NGET view of the requirement to facilitate power transfers between the All Island single electricity market and the GB market through a coordinated market study. This shared view will then be consistent with, and supported by, the process (led by ENTSO-E¹⁸) behind the production of bi-annual Ten Year Network Development Plans. The combined study could then support the case put forward to regulators (through price control submissions by the relevant transmission owners) to justify network investments.

¹⁶ More information on the Network Options Assessment and the Strategic Wider Works Process can be found at <http://www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/>

¹⁷ Eirgrid is the TSO for the Republic of Ireland (as opposed to SONI for Northern Ireland). For more information see <http://www.eirgrid.com/aboutus/>

¹⁸ ENTSO-E is the European Network of Transmission System Operators. For more information see <https://www.entsoe.eu/>

In GB, if the results of the processes outlined above suggest that it would be economic to reinforce the Scottish network, updated 'Planning Assumptions'¹⁹ would be submitted (by NGET as system operator) to SPT as the relevant transmission owner. Assuming that SPT do not choose to dispute the decision to invest, the reinforcement works would be included in their investment plan which ultimately forms part of their price control submission to Ofgem. The next Transmission Price Control, RIIO-T2²⁰, comes into effect April 2021 and any necessary reinforcements in the Moyle area will be evaluated through this process. In the event that SPT dispute the updated 'Planning Assumptions', the issue can ultimately be referred to Ofgem under the STC.

¹⁹ These set out NGET's forecasts of power flows onto and off the Transmission Owner's Transmission System under conditions which NGET reasonably foresees will arise in the course of a Financial Year

²⁰ RIIO stands for 'Revenue = Incentives + Innovation + Outputs' and is the new approach to network regulation developed by Ofgem to replace the 'RPI-X' approach previously used. RIIO-T1, the predecessor to RIIO-T2, replaced TPCR5 (Transmission Price Control Review 5).

B. Northern Ireland Network

B.1. Principles for Assessing Moyle Grid Access Capacity

SONI's primary obligation in this respect is to provide offers for new or modified connections to the All-Island Transmission Networks in Northern Ireland (Licence Condition 25 para. 2). NIE, the Transmission Owner, has a licence obligation (Condition 19 of the NIE's Participate in Transmission License) to plan and develop the transmission network in accordance with the System Security and Planning Standards and the Transmission Interface Agreement (TIA). At this stage SONI believe that MIL are a connectee to the All Island Transmission Network and, as such, have requested a modification to that connection arrangement. The interactions between SONI and NIE for processing a connection application are completed in accordance with the TIA. The TIA has been established so that both SONI and NIE comply with their respective licence obligations (Condition 18 Para 1 of the SONI's Licence).

Based on relevant planning assumptions provided by SONI as required by the TIA, NIE assesses the transmission network's capability to accommodate increased generation or demand in line with the System Security and Planning Standards. Where appropriate, NIE also evaluate the requirement for and cost of any network reinforcements required to accommodate new/modified connections.

In the case of assessing the request for increased transfer limits on the Moyle Interconnector, SONI has diverged from the typical approach which is predicated on non-discrimination between categories of transmission system users. In this instance, SONI has identified the maximum import and export limits at the Ballycronan More connection point under three distinct scenarios:

- Scenario 1** Based on the capacity of the network to facilitate imports or exports on Moyle assuming normal transmission term planning standards.
- Scenario 2** Based on shorter term transfer capacity which may be made available under prescribed operational conditions such as:
 - (i) Constrained output of other existing users; and
 - (ii) Must run generation requirements.
- Scenario 3** The potential for increasing Moyle import/export capacity in the future based on unapproved transmission reinforcements some of which may be identified in NIE's investment plan.

B.2. Technical Assessment Undertaken By NIE

The Moyle Interconnector 275kV connection point at Ballycronan More is shown in figure B1. The circuits connecting the 275kV bus into the local network are twin bundled 400mm² ACSR “Zebra” conductors with seasonal thermal ratings:

Winter	881 MVA
Spring/Autumn	820 MVA
Summer	710 MVA

These specific circuits are of sufficient thermal capacity to accommodate the Interconnectors engineering capacity of 500MW import and export via Moyle.

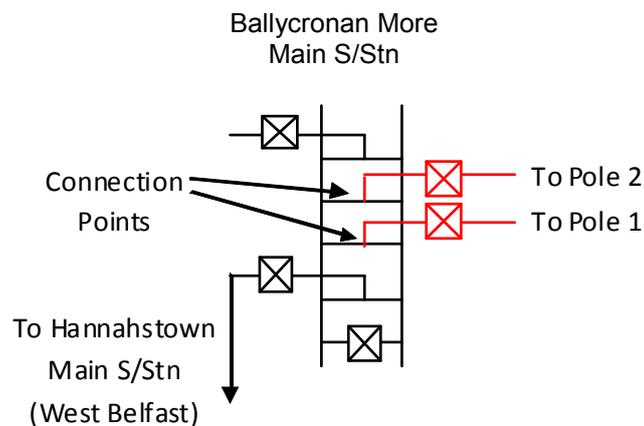


Figure B1: 275kV Connection at Ballycronan More

The local 275kV transmission network is shown in figure B2. This network is entirely constructed on double circuit steel lattice towers. Network load flow studies were completed in keeping with standard practice to assess the impact of single circuit (N – 1), and double circuit tower (N – DC) outage contingencies for winter circuit ratings. The impact of single circuit (N – 1) outages and simultaneous planned and fault outages (N – M – 1) were assessed for summer circuit ratings.

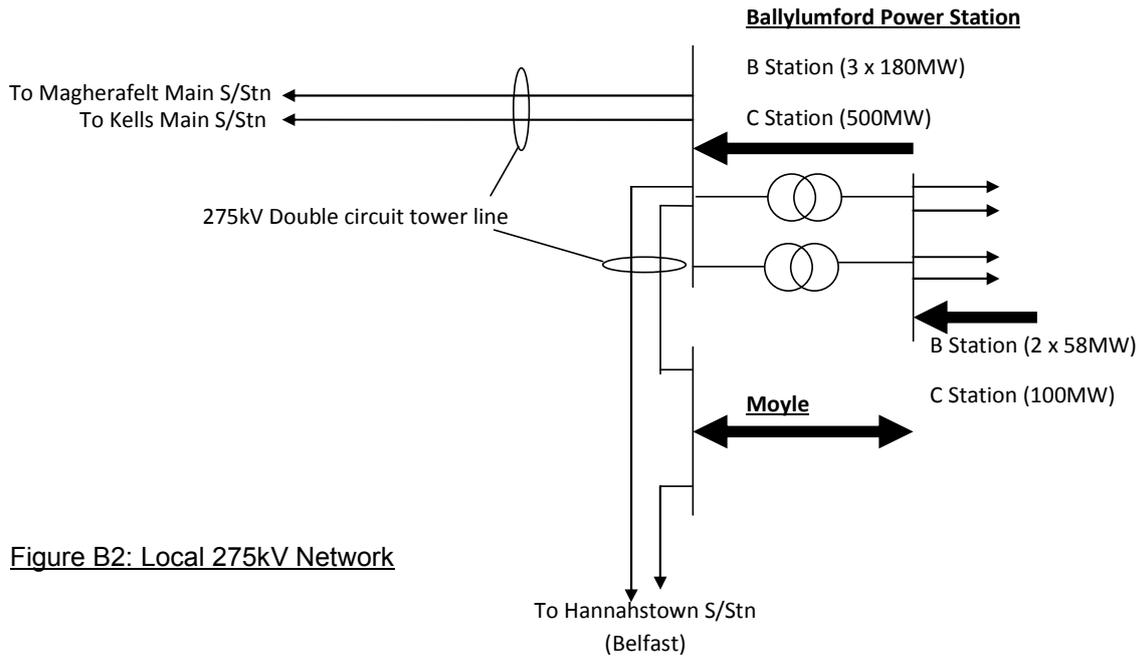


Figure B2: Local 275kV Network

Scotland to Northern Ireland Capacity

Scenario 1

Based on network access commitments to existing users including Moyle interconnector, SONI was already aware that the local network is not capable of accommodating additional import into Northern Ireland. This limit is imposed in summer due to the thermal rating of one double circuit tower line following the loss of the other and in winter due to the size of the largest set, potential 110kV overloads and risk of overload to 110kV circuits. In summary, the limits already identified in the Moyle Interconnector connection agreement cannot be increased under this scenario.

Scenario 2

In order to prioritise an import into Northern Ireland up to the engineering limit of 500MW, other generation connected to that local network may have to be constrained down by 50MW (500MW – 450MW) in winter and 100MW (500MW – 400MW) in summer. By implication, the power flows in the NI transmission system are largely unaffected by managing an enhanced import via Moyle in this manner. The recent load flow studies have confirmed this assertion.

Scenario 3

Significant network reinforcement would be required to facilitate unconstrained connection capacity up to Moyle's engineering limits. These include the following elements:

- Restringing of the 110kV double circuit line between Ballylumford and Carrmoney Main
- Additional reactive compensation in the east of NI

However, the existing connection planning standards would enable an import of 500MW on the understanding that the generation output from Ballylumford could be managed by SONI to mitigate possible network risks.

Northern Ireland to Scotland Capacity

Scenario 1

The most severe network contingency limiting the maximum permissible export is the loss of the double circuit 275kV line from Ballylumford to Ballycronan More and from Ballylumford to Hannahstown. As a result of this outage, the predominant flows to the east of the province (including the greater Belfast area and Moyle) will take less direct routes via the transmission network. The limiting factor is the maintenance of statutory voltage levels in the east of the province and potential ultimate threat of voltage instability.

Scenario 2

At present, a 300MW export can only be securely accommodated under certain dispatch scenarios. SONI can confirm that the pertinent variables are under SONI's control and that the associated risks are manageable. However, under certain circumstances, SONI's actions to facilitate the enhanced Moyle transfer may require the imposition of must run constraints on other market participants. As a result, constraint payments would be due to the affected parties.

Scenario 3

NIE's initial studies show that the installation of additional reactive support at Castlereagh and Tandragee Grid Supply Substations and the upgrade of the Ballylumford-Eden-Carnmoney 110kV corridor would facilitate a 500MW export from Moyle. This increased transfer will be considered in future Transmission Planning assumptions.

B.3. Operational Practice

Since the introduction of the Single Electricity Market (SEM) in 2007, SONI has ensured that the energy bid into the SEM by Moyle Capacity Holders has been allowed to flow. Under certain scenarios and for system security reasons this has meant that, in day, SONI has curtailed other NI generation including renewable generation. Prior to the curtailment of renewable generation, SONI will investigate the economic viability of an SO – SO trade to effect a reduction in interconnector flow. If this trade cannot be confirmed as firm in sufficient time or it is not economically viable then renewable generation in NI will be curtailed.

B.4 Future Work and Longer Term Investment – NI Network

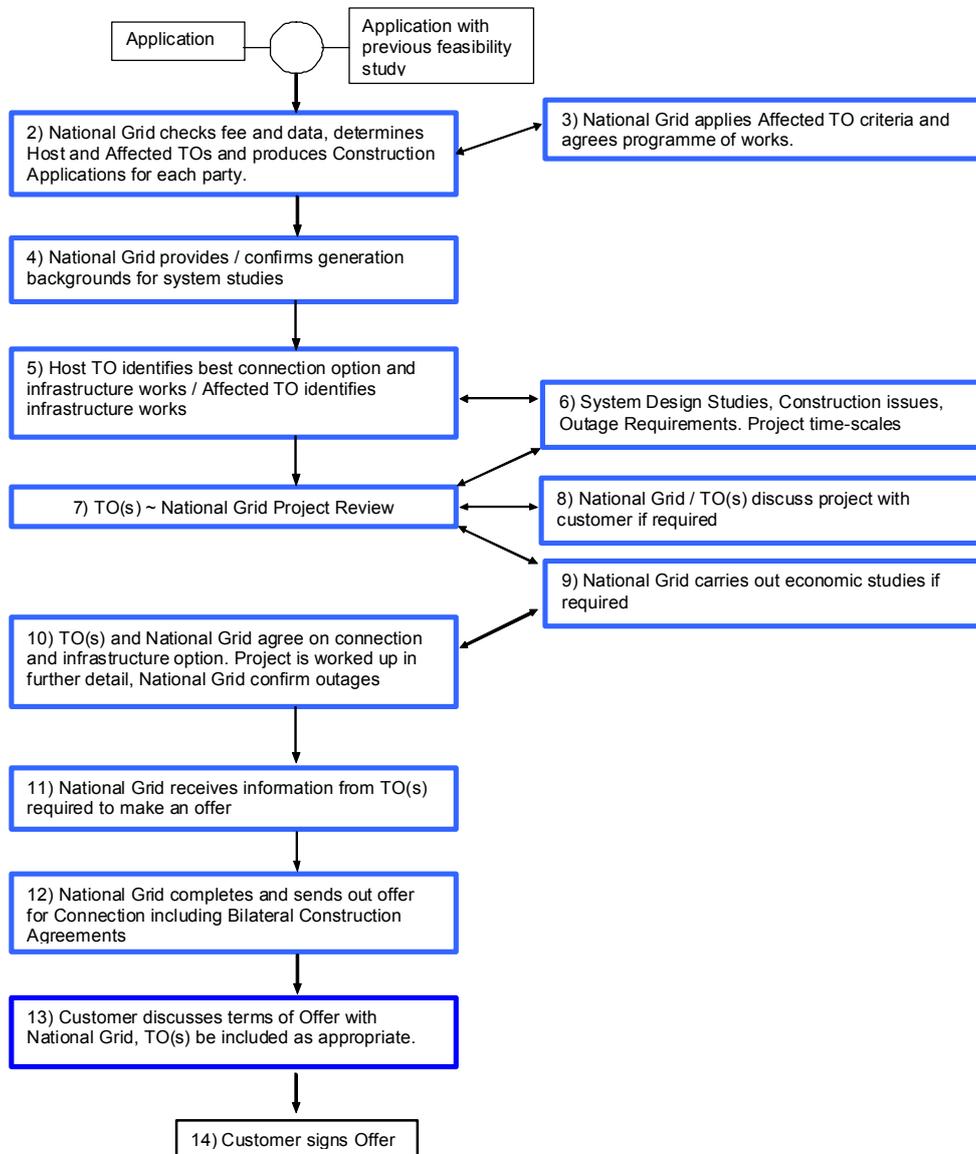
The transmission deficiencies highlighted in the SONI/NIE connection study identified issues that have already been raised in previous network analysis. SONI is aware that a number of reinforcement options which may also facilitate enhanced export via Moyle are included within the current version of NIE's Transmission Investment Plan (note as part of ongoing TIA processes SONI has a role to play in the development of NIE's Transmission investment plans). These projects may be delivered in the medium term but none are approved at this time.

However, when a clear view of the development strategy is agreed and approved, SONI and NIE will investigate the scope for further maximisation of Moyle Interconnector's connection capacity at Ballycronan More. Whilst the planned works may allow increased export capacity beyond that currently available it is very likely that further works will be required to achieve the full 500MW export.

- If the operation of the Moyle Interconnector to a higher level can be justified technically and economically then the additional reinforcement will need to be investigated and funding arranged for NIE with the Utility Regulator. The considerations in NI must take into account NGET's network development proposals and timings in Scotland;
- Utilisation of the East – West interconnector between RoI and Wales;
- The completion of the tie-line between NI and RoI.

SONI publish an annual Transmission Seven Year Capacity Statement that details existing network capacities and plans that are in place to enhance those capacities.

Appendix 1 – NGET Process for Assessing Capacity Modification Requests²¹



²¹ This process (STCP18) is part of the System Operator - Transmission Owner Code (STC) which sets out, amongst other things, the formal relationship between SPT as a transmission owner and NGET as system operator.

Appendix 2 – NGET Process for Assessing Capacity at Day Ahead Stage

Day Ahead Process

National Grid (Network Access Planning) will:

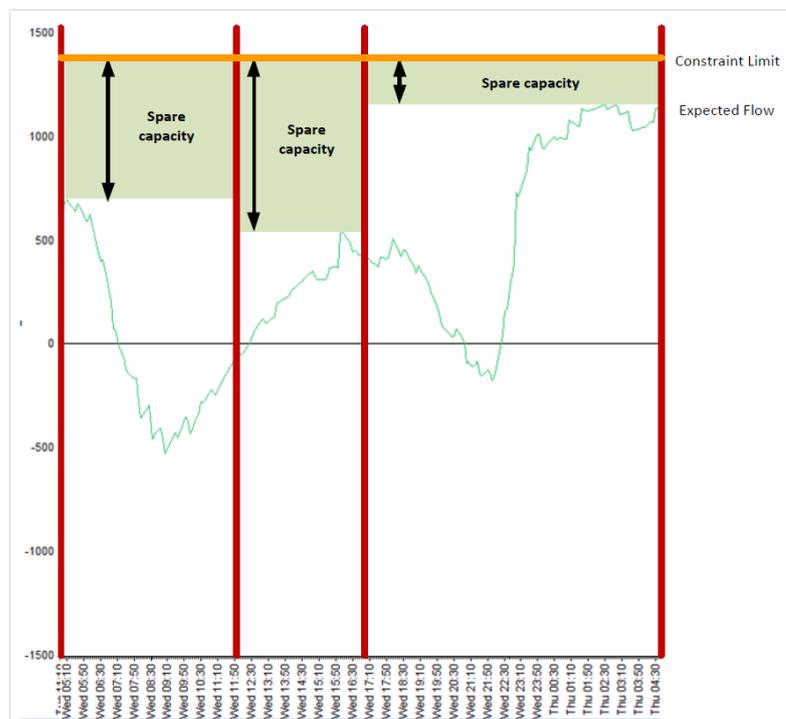
1. Use the already calculated Day Ahead system constraint limits
Constraints where Moyle is >5% effective against the limit will be considered. Constraints are bespoke and can change on a daily basis as the outage pattern, demand and generation profiles change.
2. Calculate the Expected Flow across each limit. This will be from National Grid’s existing day ahead scenarios with the exception of:
 - a. Wind forecast (all wind with a bilateral contract, e.g. BEGA, BELLA, BCA) will be scaled up to 90th percentile
 - b. the Physical Notification (PN) position. MIL require capacity allocation prior to 1100hrs. The day ahead position is only available after this time hence the plant position shall be calculated as follows:
 - i. Use the previous day PN position as a baseline
 - ii. Remove/add generators confirmed as starting/returning from outage (as declared by the generating parties, taken from National Grid’s TOGA database)
 - iii. Amend the PN position of generators that have been scheduled by the GB System Operator Commercial Operation team to be traded.

For the avoidance of doubt, the NG day ahead scenarios also include:

- *A complete Day Ahead outage plan*
- *Demand forecast as presented by the NG Energy Forecasting team*
- *Embedded generation as presented by the NG Energy Forecasting team*

For all of the above, NG will apply no additional risk scaling

3. Calculate capacity available as the difference between the Constraint Limit and the Expected Flow (diagram provided as example)



4. Provide three data points of optimised capacity available, (05:00, 12:00, 17:00) to the Commercial Operations team (weekday) or Electricity National Control Centre (weekend) for review

National Grid (Commercial Operations / ENCC) will:

5. Review the data points against requirements to maintain access to generation in order to control the GB System and amend if necessary. These include, but are not limited to:
 - a. Reserve / Response requirements
 - b. Frequency Regulation requirements
6. Return the revised data points to Network Access Planning

National Grid (Network Access Planning) will:

7. Email the optimised capacity data points to Mutual Energy and SONI by 10:30 each day
Note: Network Access Planning does not resource Saturdays and work reduced patterns during bank holidays. In all cases, the capacity allocation data will be sent on the preceding working day (e.g. Friday for Sunday during a normal working week).

SONI will:

1. Confirm the result of its calculation of capacity available on the NI network.
2. Compare the NG and SONI data points and use the lowest of the two numbers as the cross zonal capacity for each period.
3. Enter the cross zonal capacity figures into the relevant IT systems²², so that the calculated capacity is made available for market coupling processes

Caveats:

1. Force Majeure – if NGET wind forecasting systems or scenario models fail, then NGET will offer no optimised capacity that day; if SONI interconnector systems fail then no additional capacity will be made available.

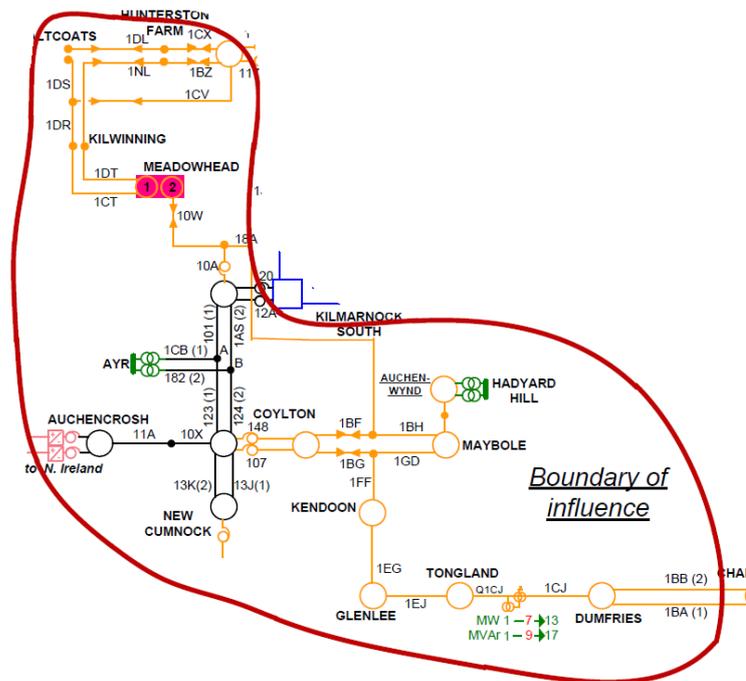
²² SONI will perform these tasks in its role as Interconnector Administrator and interim coordinated capacity calculator.

Appendix 3 – NGET Process for Assessing Capacity at Two Day Ahead Stage

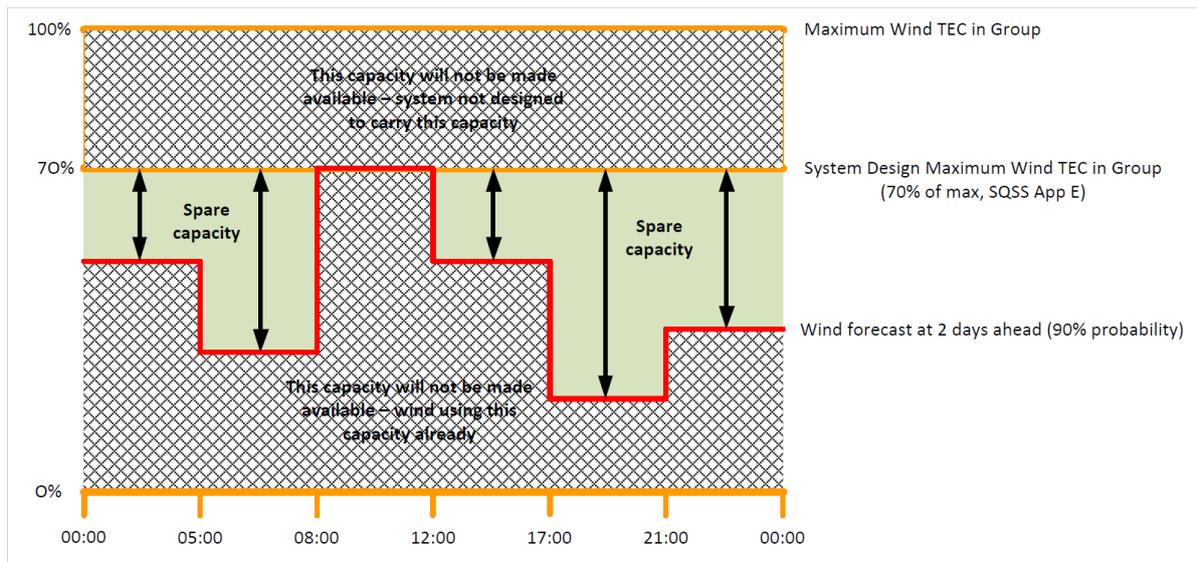
2 Day Ahead Process

National Grid (Network Access Planning) will:

1. Determine the maximum wind TEC available within the boundary of influence as described by the below diagram. This will be taken from the National Grid Wind Forecasting Tool, which corresponds with the TEC register.



2. Calculate the “System Design Maximum Wind TEC” (the TEC within the boundary of influence that the system was designed to)
 - SQSS Appendix E3 determines the scaling factor for wind to be 70%:
 - [E.3 In the Economy planned transfer condition the registered capacities of certain classes of power station are scaled by fixed factors, known as DT, for classes T of power station. These factors are set as follows:
 - E.3.2 For stations powered by wind, wave, or tides, $DT = 0.70$.]
3. Review the 90th percentile wind forecast against the System Design Maximum Wind TEC
4. Provide six data points of additional capacity available, (00:00, 05:00, 08:00, 12:00, 17:00, 21:00) to the Commercial Operations team for review (diagram copied below as visual aid to understanding the process)



National Grid (Commercial Operations) will:

5. Review the data points against requirements to maintain access to generation in order to control the GB System and amend if necessary. These include, but are not limited to:
 - a. Reserve / Response requirements
 - b. Frequency Regulation requirements
6. Return the revised data points to Network Access Planning

National Grid (Network Access Planning) will:

7. Email the additional capacity data points to Mutual Energy and SONI by 13:30 each day
Note: Network Access Planning does not resource Saturdays and work reduced patterns during bank holidays. In all cases, the capacity allocation data will be sent on the preceding working day (e.g. Friday for Monday during a normal working week).

SONI will:

1. Confirm the result of its calculation of capacity available on the NI network.
2. Compare the NG and SONI data points and use the lowest of the two numbers as the cross zonal capacity for each period.
3. Enter the cross zonal capacity into the auction management platform (AMP) to be used in the day ahead and subsequent intraday capacity actions the following day

Note that the additional capacity will be released in whole trading day blocks at the same quantity (so that the additional capacity will be set by the highest wind forecast during the whole day). This is due to limitations within the SONI systems.

Caveats:

1. Force Majeure – if NG wind forecasting systems fail, then NG will offer no optimised capacity that day; if SONI interconnector systems fail then no additional capacity will be made available.
2. If a significant outage / fault is to take place within the boundary of influence, National Grid can inform MIL via email that this service is suspended and offer no additional capacity for the duration of the outage period.