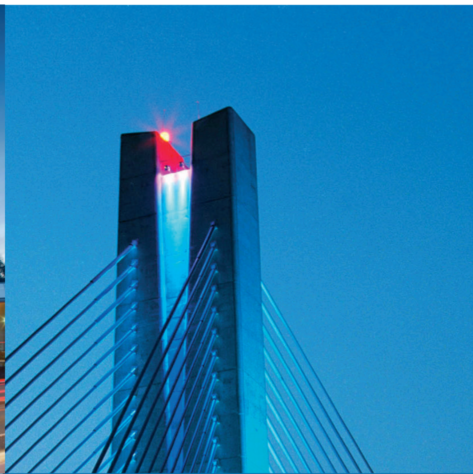
APPENDIX 2.1

The Need for a Second North-South Electricity Interconnector

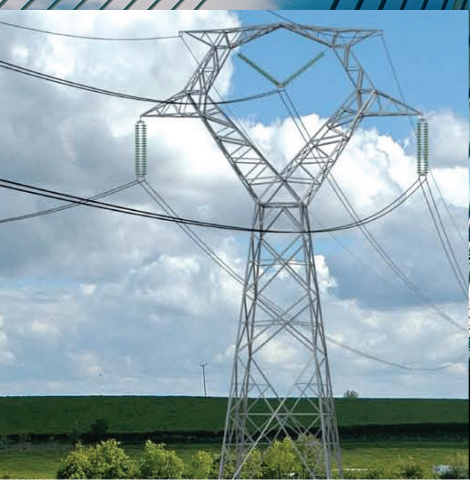
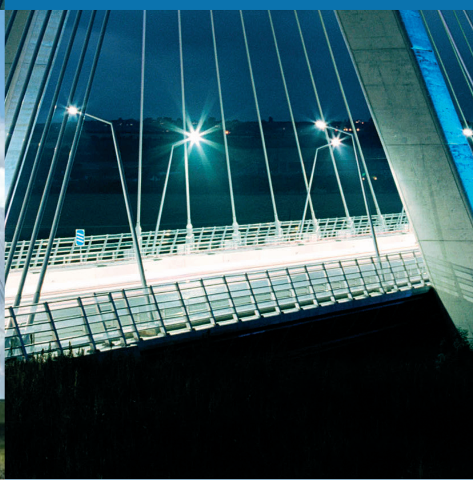
(2015)

North-South 400kV
Interconnection
Development

The Need for a second North-South Electricity Interconnector

May 2015

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Report produced by EirGrid and SONI

1. INTRODUCTION

The proposed installation of the second North South electricity interconnector is a critical and strategically urgent transmission reinforcement for the island of Ireland. This report has been prepared by EirGrid / SONI and it details the strategic need for the project along with the benefits of increased security of supply and reduced electricity costs that follow from the delivery of the new transmission circuit.

Section 2 sets out the need for the Interconnector discussing the limitations of the transmission network that exists between Ireland and Northern Ireland today and how the construction of the new Interconnector will allow these limitations be removed.

Section 3 provides a detailed breakdown of the benefits to the users of the all-island electricity system that will be delivered by the second North-South Interconnector.

Section 4 provides a summary of this report.

EirGrid / SONI have followed accepted industry practice in the preparation of this document. The modelling and studies undertaken to support the information given in this report utilise data and assumptions based on publicly available data as far as possible and references are provided where applicable.

2 NEED FOR THE INTERCONNECTOR

At present, a Single Electricity Market[1] (SEM) exists on the island of Ireland into which electricity generators based in both Ireland and Northern Ireland sell their power, and from which electricity suppliers in both Ireland and Northern Ireland buy their power. The overarching operating principle of this single electricity market is that demand for electricity should be met in the cheapest way possible. As such the SEM stacks the available generators on any given day in order from lowest price to highest price and uses the generators in this order to produce electricity up to the point where demand is satisfied.

Intuitively to allow this to happen the cheapest produced electricity must be able to flow freely without any significant impediment from where it is generated to where it is consumed. In industry terms, sufficient transfer capacity must exist to move the electricity from source to demand. Within Ireland, Northern Ireland and worldwide, the high voltage electricity transmission system is used to facilitate this efficient transfer of electricity.

However, a significant bottleneck exists between the transmission systems of Ireland and Northern Ireland such that the cheapest produced electricity on the island of Ireland cannot be physically transferred to where it is required at all times of the year. This bottleneck acts to increase the cost of producing electricity on the island of Ireland.

Critically, this bottleneck also affects the strength and resilience of both transmission systems on the island.

This bottleneck exists as a consequence of only having one high capacity interconnector link between the transmission systems of Ireland and Northern Ireland. There are also two much smaller capacity connections between Donegal and Tyrone, and Cavan and Fermanagh which were designed to provide limited support to the local electricity networks in those areas rather than the wider transmission system. Neither of these connections on their own or combined have sufficient capacity to

[1] 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.

securely maintain the connection between the Irish and Northern Irish transmission systems.

At present, this single interconnector between Louth and Armagh is comprised of what is known as a double circuit i.e. two 275 kV (kiloVolt) high voltage power lines which are supported from the same set of structures and towers. Each power line has the ability to carry 750 MW of power at its maximum level. In reality however, the current interconnector is prevented from carrying anywhere near this amount of power as to do so would put the stability of both the Irish and Northern Irish transmission systems at serious risk and would create an elevated risk of a black out.

The reasons for this are relatively straightforward. EirGrid and SONI are mandated by licence to design the transmission systems of the two jurisdictions to be robust and secure against a single event causing the reliability and quality of the electricity supplied to customers to deviate from specified standards. This means that EirGrid and SONI must design the transmission systems to be able to withstand the loss of a single piece of that system, e.g. a power line, without affecting the electricity supply to the end user. The loss of a power line can have several causes such as lightning strikes, accidental or deliberate damage to a tower structure, fire or a mal-operation of the complex power system protection schemes. Sufficient resilience is built into the Irish and Northern Irish internal transmission systems to deal with existing demands[2]. If one power line in either of these systems fails, the meshed nature of those systems means that the other power lines in the system take up the slack and electricity still flows uninterrupted to the end customer.

However, as there is only a single high capacity connection between Ireland and Northern Ireland at present, the loss of this connection will result in a situation where the power systems of Ireland and Northern Ireland will be isolated from each other. An event such as this is known as 'System Separation'. During a system separation event, depending on how much power was flowing across the interconnector prior to system separation, one system will have a shortage of power or electricity, whilst the other will have too much power. Either of these situations can have serious consequences for the security of supply in one or both jurisdictions.

An excessive shortage of power is corrected by disconnecting electricity customers from the network which in itself is an undesirable situation. A surplus of power is corrected by automatically reducing the amount of power generated by power stations. If these corrective actions are not taken quickly enough (i.e. within a matter of seconds) then one or both power systems will potentially collapse resulting in black-outs.

At present, to mitigate the risk to either system during a system separation event, the upper limit on the amount of power allowed to be transferred between Northern Ireland and Ireland is 450[3] MW (Megawatts[4]) and from Ireland to Northern Ireland is 400 MW. For simplicity it has been assumed that the amount of power that can be transferred in either direction is 450 MW. In practise during normal operation of the transmission system, a limit of 300 MW applies in either direction as 150 MW of transfer capacity should be kept free to allow one transmission system provide the other with reserve power in the event of the unexpected loss of a

[2] In future due to the changing nature of how power is generated and consumed in Ireland, the present transmission systems will have to be upgraded to ensure this resilience is maintained. This is the genesis of the Grid25 program

[3] http://www.eirgrid.com/media/OperationalConstraintsUpdateVersion1_19_November_2014.pdf

[4] One Megawatt is equivalent to 1,000 kilowatts (kW). In energy terms, one unit of electricity is one kW consumed over one hour, i.e. 1 kWh. In the power industry units of energy are represented as MegaWatt hours (MWh). One MWh = 1,000 kWh.

generator in either jurisdiction. During regular and unscheduled maintenance it is normal for these limits to be further reduced.

In summary, to transfer in excess of 450 MW on the current North South Interconnector would be considered to be putting the power systems of Ireland and Northern Ireland at unacceptable risk. This 450 MW limit is known as the 'Total Transfer Capacity' (TTC) of the current North South Interconnector.

A second North South interconnector, physically separate and distant from the first, is hence required to provide added resilience to both transmission systems in the event that one of the interconnectors fail. In the event of either of the two interconnectors failing, the other interconnector will automatically be able to increase its power flow to compensate for the other and continue flowing power efficiently between the two transmission systems until such a time as the other interconnector is returned to service or other remedial actions are taken by the transmission system operators. Once the second North South interconnector is in place the amount of power that can flow between the two transmission systems will be more than doubled to 1,100 MW during normal system conditions.

In addition to enhancing the resilience of both transmission systems, in increasing the transfer capacity to 1,100 MW the second North South interconnector will eliminate the aforementioned bottleneck, thus facilitating continued downwards pressure on electricity costs by allowing the cheapest sources of electricity serve demand and ensuring that power can flow freely between jurisdictions without significant impediments. The benefit of alleviating this bottleneck in terms of generating cheaper electricity will be examined in section 3.3.

A further consequence of the transmission system bottleneck that exists between Ireland and Northern Ireland is that it is currently not possible to access the full security of supply benefits of all of the power generators on the island, because of the limitation on the amount of support each system can provide to the other. Previous 'All Island Generation Capacity Statements'[5] identified an increased risk to security of electricity supply in Northern Ireland from 2016 onwards. These documents highlighted the likelihood of electricity supply shortfalls arising from the planned closure of several power generators (required in order to comply with EU emissions directives), and showed that, in the continuing absence of a second North South interconnector, there was likely to be a serious shortfall in the available sources of electricity supply in Northern Ireland in the years ahead. Such shortfalls may give rise to the necessity to disconnect portions of the electricity supply at times of peak demand in order to prevent system collapse. Despite the signing of a local reserve services contract, the construction of the second North South interconnector is the optimum solution available to alleviate this security of supply risk and allow the surplus of generation capacity which exists in Ireland to be counted towards security of supply in Northern Ireland. The benefits arising from this extra security of supply are detailed in section 3.1.

In summary, there is a clear need for a second North South interconnector. The needs identified cover 3 main areas:

- Improving security of supply,
- Removing the bottleneck between the transmission systems thus facilitating the most efficient transfer of power across the island.
- Facilitating the integration of renewable power sources onto the electricity system

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

3 BENEFITS OF THE NEW INTERCONNECTOR

This section describes the significant benefits in terms of increased security of supply and lower electricity costs that the construction of the second North South interconnector will bring to the all-island electricity user.

EirGrid / SONI has performed detailed analysis, described here, identifying these benefits by examining a range of power system indicators such as generation adequacy, network security, and the cost of producing power for the years 2020 and 2030. This analysis encompassed a range of scenarios and sensitivities using the most detailed and recent information and forecasts available for electricity demand, the portfolio of power generators and the costs of burning fuel to produce electricity.

A significant security of supply benefit in addition to substantial savings in the cost of producing electricity has been identified. The combined value of these benefits has been assessed collectively to deliver a range of benefits of the order of €20m per annum in 2020 rising to between €40m - €60m per annum from 2030. The following sections examine these benefits in more detail.

3.1 IMPROVED SECURITY OF SUPPLY

As discussed previously, the addition of the new interconnector will effectively remove the existing bottleneck that limits power flows between Ireland and Northern Ireland. Removing this restriction will enhance cross-border support in the event of a shortage of electricity in either jurisdiction, thus ensuring security of electricity supply throughout the island of Ireland. This security of supply benefit is highlighted in the 'All-Island Generation Capacity Statement 2015-2024'[6], which outlines the importance of the second interconnector for generation adequacy in Northern Ireland particularly from 2021 onwards.

The security of supply benefit of the existing North-South interconnector has been estimated at 300 MW in total[7] i.e. the requirement for generation plant on the whole island is 300 MW less than if the two jurisdictions were completely separate. This benefit can be split between the two jurisdictions as 100 MW in Ireland (capacity support from Northern Ireland) and 200 MW in Northern Ireland (capacity support from Ireland).

With the second North-South interconnector in place, the transfer capability will increase, and effectively there will be no transmission limitations between the two jurisdictions. Each system will then be able to assist the other to a greater extent. In effect generation capacity on the island can be utilised much more economically and efficiently.

In order to determine a long-term, robust and appropriate security of supply benefit figure, a range of possible study assumptions were investigated thoroughly by assessing the additional security of supply benefit over a range of years from 2018 to 2030 with different power system characteristics. The most appropriate approach in determining the benefit is the one endorsed by the regulatory authorities in determining the Capacity Payment Pot

[6] http://www.eirgrid.com/media/Eirgrid_Generation_Capacity_Statement_2015-2024.pdf

[7] Within the Security of Supply studies performed, for each area separately, the electricity demand was reduced in a single-system study until the generation adequacy matched that of a two-area study – this electricity demand reduction is equivalent to a reliance on the other system, and thus represents the capacity benefit attributable to the current North-South interconnector.[8] For an outline, see http://www.allislandproject.org/en/cp_decision_documents.aspx?article=ba1ce3a7-23ff-4dd3-8a88-cd715106eeaa

Size[8]. This approach results in a security of supply benefit ranging from 240 MW to 268 MW. Therefore it is reasonable to estimate that the additional security of supply benefit from the second North-South interconnector is at least 240 MW on an enduring basis. The additional security of supply benefit can be converted into monetary terms by using the cost of a new peaking generator from the SEM Committee Decision Paper on the capacity requirement and annual capacity payment sum for 2015[9].

Applying this to the security of supply benefit results in an annual enduring security of supply benefit value from the second North-South interconnector of approximately €19 million per annum[10].

It is also necessary to examine when the additional security of supply benefit comes into effect. While both jurisdictions are in generation capacity surplus today, previous 'All-Island Generation Capacity Statements' have highlighted that without the second North-South interconnector, the ability of generation in Northern Ireland to meet forecast demand would be subject to significant risk from 2016.

SONI has taken action to address the risk to Northern Ireland security of supply 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 continued operation of two of the generation units at Ballylumford at a slightly reduced capacity which alleviates the security of supply situation for the term of the contract. The cost of this contract is approximately GB£8m[11] per annum. This means effectively that the absence of the second North South interconnector is costing electricity consumers at least £8m per annum today.

Recently, Moyle Holdings has indicated that remedial work will be undertaken to return the Moyle Interconnector to an import capacity of 450MW. We have assumed that the full Moyle Interconnector transfer capacity will be back in place by 2018. This has been taken into account in our assessment of the security of supply benefit.

The security of supply cost of not having the second North South interconnector begins in 2016 with the start of the local reserve services contract. It can be assumed that the full enduring capacity benefit of the second North-South interconnector will begin to apply between 2020 and 2030. This security of supply benefit saving has been calculated to be worth at least €19m per annum on an enduring basis. Of course, the security of supply benefit of the second North-South interconnector is not exclusive to one jurisdiction or the other. It is a shared benefit, but this benefit happens to be more obvious for Northern Ireland in the near to mid-term.

3.2 NETWORK SECURITY BENEFIT

As previously described the main transmission connection between Ireland and Northern Ireland is one 275kV double circuit. This limitation has an on-going impact on the day to day operation of the all-island transmission system. To operate the system securely means that the System Operators must ensure that certain contingencies are covered in the

[8] For an outline, see http://www.allislandproject.org/en/cp_decision_documents.aspx?article=ba1ce3a7-23ff-4dd3-8a88-cd715106eeaa

[9] http://www.allislandproject.org Single Electricity Market Capacity Requirement and Annual Capacity Payment Sum for Calendar year 2015

[10] Assuming we round down to the nearest million euro.

[11] Actual cost is estimated at GB£8.9m. In this paper we round down to GB£8m. http://www.uregni.gov.uk/uploads/publications/DETI_-_Utility_Regulator_-_Updated_Security_of_Supply_Paper_-_22_Dec_14_draft_2.pdf

event of failure or outage of certain system parts, i.e. generators or circuits. For the loss of any single item of plant the system should remain capable of meeting all required standards such as: voltage, frequency, stability.

In Northern Ireland, existing Operating Standards indicate that the loss of a double circuit such as the existing North–South interconnector is treated as a single item. This means that, in day to day operation, generation plant on the island of Ireland is scheduled to meet demand in such a way as to ensure that there are always three main conventional generators operational in Northern Ireland. A minimum of three generating units would be required to maintain all reliability and quality standards in Northern Ireland should it become separated from the Irish transmission system. This results in less (economic) efficient dispatch of generation than would otherwise be the case.

With the completion of the second North–South interconnector, all-island generation can be operated more efficiently. With two interconnectors (the existing double circuit and the proposed single circuit) there is no longer a need to consider the possibility of system separation in day-to-day operational practices. This means that the need to operate three generation units in Northern Ireland can be reconsidered.

Studies carried out by EirGrid/SONI (using all-island network models) indicate that once the second North-South interconnector is completed it is possible to operate the all-island system securely with all reasonable contingencies taken into account with two large conventional generation units operational in Northern Ireland. This conclusion has been factored into this benefit analysis as described in section 3.3.2.

3.3 REDUCED ELECTRICITY COSTS

At present the bottleneck between the transmission systems of Ireland and Northern Ireland prevents the cheapest available generators from supplying electricity demand at all times.

There are two main categories of power generator in existence on the island of Ireland today: renewable generators and fossil-fuelled generators. Renewable generators are predominantly comprised of wind turbines with a smaller amount of hydro power plants, and also some solar generation. Renewable generators have no fuel cost, and hence from the point of view of a wholesale electricity market are priced at zero.

Fossil-fuelled generators burn a fuel to produce electricity. The fossil-fuelled generators considered in this paper are gas, coal, and to a lesser extent distillate oil, peat and biomass fuelled. As there is a cost to producing and distributing these fuels, these generators have a certain cost of producing electrical power, and hence in the wholesale electricity market are priced above zero.

The future generation portfolio on the island of Ireland will be comprised mainly of gas-fired Combined Cycle Gas Turbines (CCGT[12]), wind generators and some coal generators in certain years and scenarios. There has been significant investment in modern CCGT in Ireland over the last 5 years, with further investment expected in the coming years. This has all led to Ireland having a large capacity of high efficiency, and hence lower cost, CCGT units. Northern Ireland has not had the same extent of investment in the power sector, such that in general, the CCGT units in Northern Ireland are older, less efficient and consequently more expensive than generators in Ireland.

[12] CCGTs are the most efficient power plants available today with standard efficiencies in Ireland of between 50% – 60%. The more efficient a generator, the less fuel it burns to produce a MWh of power, the cheaper it is.

However, both Ireland and Northern Ireland have also seen significant expansion of renewable generation recently (predominantly wind generation) recently and this is expected to continue as both jurisdictions attempt to reach renewable energy targets by 2020 and decarbonise their economies beyond this date.

The absence of sufficient interconnection between Northern Ireland and Ireland means that the cheaper generators located in Ireland cannot at times serve electricity demand in Northern Ireland and vice versa, whilst also serving as an impediment towards sharing wind generation across the island as required. This results in an increased cost for the electricity consumer, meaning that the full benefits of the SEM (and the I-SEM in the future) are not being realised at present. The construction of a second interconnector between Northern Ireland and Ireland will allow more benefits of the electricity market to be realised through the running of the cheapest available generators on the island to meet electricity demand.

EirGrid/SONI has performed a detailed set of studies which estimate the cost of producing power by assessing the fuel cost and other running costs of electricity generators on an annual basis. These studies can be used to estimate the savings in the cost of producing electricity that the construction of the new North-South interconnector will bring. These studies simulate the operation of the electricity market on what is known as the short-run marginal cost basis for every hour of the year. The short-run marginal cost of each generator is assessed by calculating how much fuel that generator burns to produce one MegaWatt hour (MWh) of energy, while taking into account the cost of starting up generators, emissions costs and other technical limits. These studies emulate the operation of the electricity market by seeking to run the cheapest generators to meet the given electricity demand.

3.3.1 Assumptions and Scenarios for the Study

These studies utilise a set of assumptions that describe the key study inputs such as future electricity demand, wind power generation levels, fossil fuelled generator portfolio and fuel prices. Where possible these assumptions have been based on publicly published and reviewed data e.g. for generator characteristics, we have used the regulators' 2012-2013 Validated SEM Generator Data Parameters[13], for forecasted fuel prices we have used a variety of IEA World Energy Outlook 2013 scenarios[14]. The data assumptions and sources to the study are summarised in table 1.

Assumption	Source
Fuel and CO_2 Prices	IEA World Energy Outlook 2013 , Market prices at close 16/02/2015.
Electricity Demand	2015-24 Generation Capacity Statement
2020 Generation Portfolio	2012-2013 Validated SEM Dataset
2030 Generation Portfolio	Vision 1 and 3 datasets for ENTSOE TYNDP 2016.

Table 1: Sources of data assumptions

While the focus of the studies is on the Ireland and Northern Ireland power systems, the study also accounts for flows on the interconnectors[15] between the island of Ireland, Great Britain and France.

[13] http://www.allislandproject.org/en/market_decision_documents.aspx?page=2&article=261a5576-bd83-4544-b250-7b18b55bd9ba
[14] http://www.worldenergyoutlook.org/publications/weo-2013/
[15] For the 2020 and 2030 vision 1 scenario, Moyle import/export capacity is 450/80MW, EWIC import/export capacity is 500/500MW, for 2030 vision 3 scenario an additional 700MW import/export is modelled.[16]
http://www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/Electricity-Ten-Year-Statement/

A simplified approach is used where the Great Britain and France markets are modelled using price profiles from a model based on the National Grid 10 year statement 2014-24[16] for 2020, and ENTSO-E Ten Year Network Development Plan (TYNDP) data for 2030.

Two sets of studies to assess the reduction in the cost of producing power have been performed, one in 2020 and the other in 2030.

2020 is the year where Ireland and Northern Ireland's 40% renewable energy target should be met.

The year 2030 was chosen as it aligns with the visions being used for ENTSO-E's Ten Year Network Development Plan 2016.

For 2030, Vision 3[17] has been chosen as the central scenario as it describes a potential path for the island of Ireland's transition towards 2050 European Union de-carbonisation targets. This scenario describes a future power system with a higher level of renewable electricity generation than in 2020 with both Ireland and Northern Ireland's renewable penetration level set at 55% of demand. In addition a 700 MW interconnector is modelled between Ireland and France and coal-fired generation has been removed[18] and re-powered with gas-fired CCGTs.

Within each study year two scenarios have been studied. The first of these is the central scenario, which is assumed to represent the most likely scenario given the input assumptions. In addition to the central scenario, a sensitivity scenario has also been assessed. The sensitivity scenario uses more pessimistic assumptions which lead to lower savings in the cost of producing electricity. The 2020 sensitivity scenario assumes a substantially lower fuel and CO_2 cost. This scenario is intended to assess the impact of a continuation of the low fuel prices which are being seen today remaining unchanged until 2020. The 2020 sensitivity study uses the market prices seen at close of business on the 16/02/2015. In the 2030 sensitivity scenario a lower electricity demand and renewable penetration is assumed than the corresponding 2030 central scenario which again leads to lower savings in the cost of producing electricity.

For each scenario, the model calculates the overall cost of producing power with and without the second North-South interconnector and the difference is the saving attributable to the second North–South interconnector.

3.3.2 Reductions in the cost of Producing Power

A detailed set of studies has been performed examining a range of scenarios and assumptions. On the basis of these studies, EirGrid estimates that the annual savings in the cost of producing power would be of the order of those presented in Table 1.

Production Cost Savings Scenario	2020	2030
Central	€20m	€40m[19]
Sensitivity	€13m	€20m[20]

Table 2: Electricity production cost saving summary for 2020 and 2030 studies

[16] http://www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/Electricity-Ten-Year-Statement/
[17] https://www.entsoe.eu/major-projects/ten-year-network-development-plan/FAQs/Pages/5.-2030-Visions.aspx details the scenarios to be used in the Ten-Year Network Development Plans (TYNDP) in compliance with Regulation (EC) n. 714/2009
[18] We assume that European emissions regulations have stopped unabated Coal fired generators from producing power as they emit too much Carbon Dioxide.

[19] Based on dataset used for ENTSOE Vision 3 scenario
[20] Based on dataset used for ENTSO-E Vision 1 scenario

There are four main drivers for these savings:

1) Higher power flow capability: i.e. more efficient generators can be dispatched[21] to meet all-island demand arising from the ability to flow more power in both directions.

2) Reduction of Northern Ireland must run units constraint: i.e. the relaxation of operational rules from 3 units that must run at all times to 2 that is permissible once the new interconnector has commissioned.

3) Reserve[22] Dispatch Efficiencies: i.e. further savings arise from a more efficient reserve dispatch.

4) Reductions in wind curtailment and constraint i.e. an increase in power production from wind generation.

In 1) to 3) above more efficient and cheaper generators located in Ireland produce more power replacing less efficient and hence more expensive generators in Northern Ireland. In point 4) zero priced wind generation located across the island displaces more expensive fossil fuel generation.

In both 2020 scenarios the main drivers for savings are points 1) – 3) with a small percentage of savings coming from point 4). The 2020 sensitivity scenario assumes that the price of power is substantially cheaper than in the central scenario. This results in lower production cost savings of the order of €13m per annum in the sensitivity case. In the 2020 central case production cost savings of the order of €20m are seen. This case is considered the most likely outcome for 2020.

In the 2030 central scenario drivers 1) – 4) account for all of the approximately €40m in electricity production cost savings with a sizable percentage of the savings coming from reductions in wind curtailment and constraint (increases in wind energy production).

In the 2030 Sensitivity, renewable penetration levels are assumed to stay close to 2020 levels meaning little extra wind generators are installed over and above the 2020 total. This scenario gives a saving of the order of €20m saving in 2030. The electricity production cost saving drivers in the sensitivity scenario are largely the same as those for the 2020 studies.

Figures 1 and 2 show the representative volume of power flows between each jurisdiction which produce the electricity production cost savings in 2020 and 2030 and are made possible by the increase in transfer capacity brought about by the new interconnector and the ability to move cheaper power from Ireland to Northern Ireland and vice versa and produce more wind energy across the whole Island. The red bars in figures 1 and 2 shows the representative volume of flows without the new Interconnector whilst the blue bars show the representative volume of flows with the new interconnector.

[21] The dispatch is essentially the stack of generators which are producing power at a given time to meet demand.

[22] The transmission system operators must maintain a certain amount of reserve power to be used in the event of the unexpected failure of a generator or a transmission system fault.

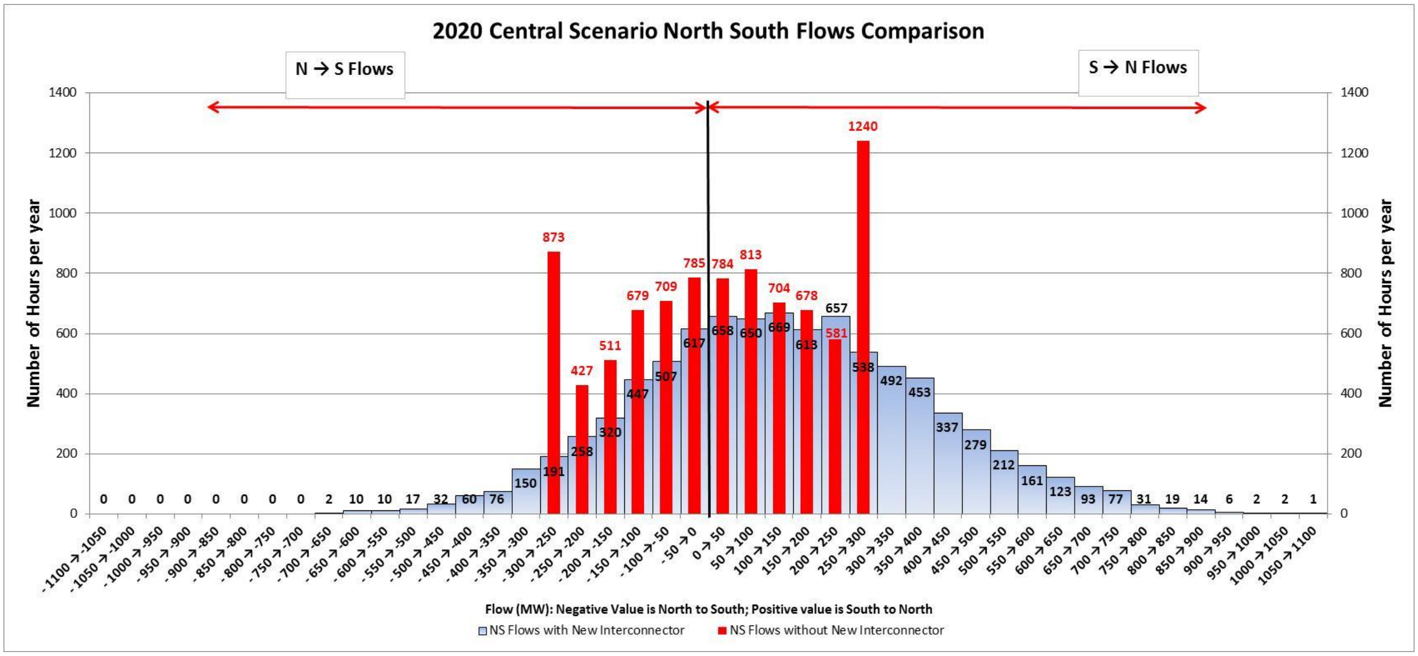

Figure 1: Representative histogram of flows in 2020 between Ireland and Northern Ireland with the new North South Interconnector.

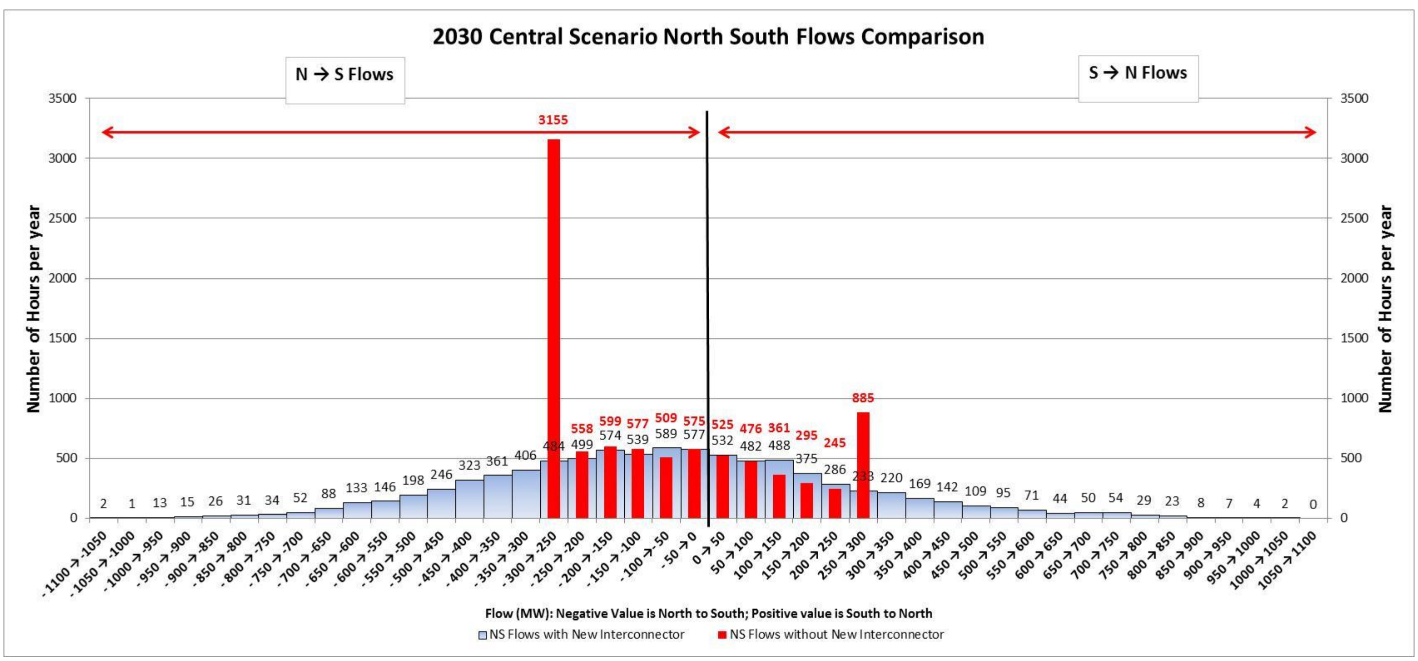

Figure 2: Representative histogram of flows in 2030 between Ireland and Northern Ireland with the new North South Interconnector.

It should be noted that ENTSO-E also produce studies associated with projects such as the second North South interconnector. The studies assessed under the TYNDP process can be more limited than the detailed modelling approach we have undertaken here. For example, the ENTSO-E studies may not take into account operational changes such as the change in the amount of must run units required which, as seen earlier, can be a significant portion of the reduction in electricity costs.

4 CONCLUSION

The proposed second North-South interconnector is a critical and strategically urgent transmission reinforcement. This report details the need for the second North-South interconnector and the benefits that will accrue from its delivery.

Comprehensive and detailed studies have been undertaken, examining a range of power system indicators such as generation adequacy and security of supply, network security, and the costs of producing electricity for the years 2020 and 2030. These studies encompass a range of scenarios and sensitivities using current forecasts for demand, generation portfolio and fuel prices.

In summary, a range of electricity production cost and security of supply benefit savings can be attributed to the construction of the second North-South interconnector with combined annual electricity production cost and security of supply savings of the order of €20m per annum in 2020 rising to between €40m - €60m per annum from 2030.

The range of overall benefits is shown in figure 3.

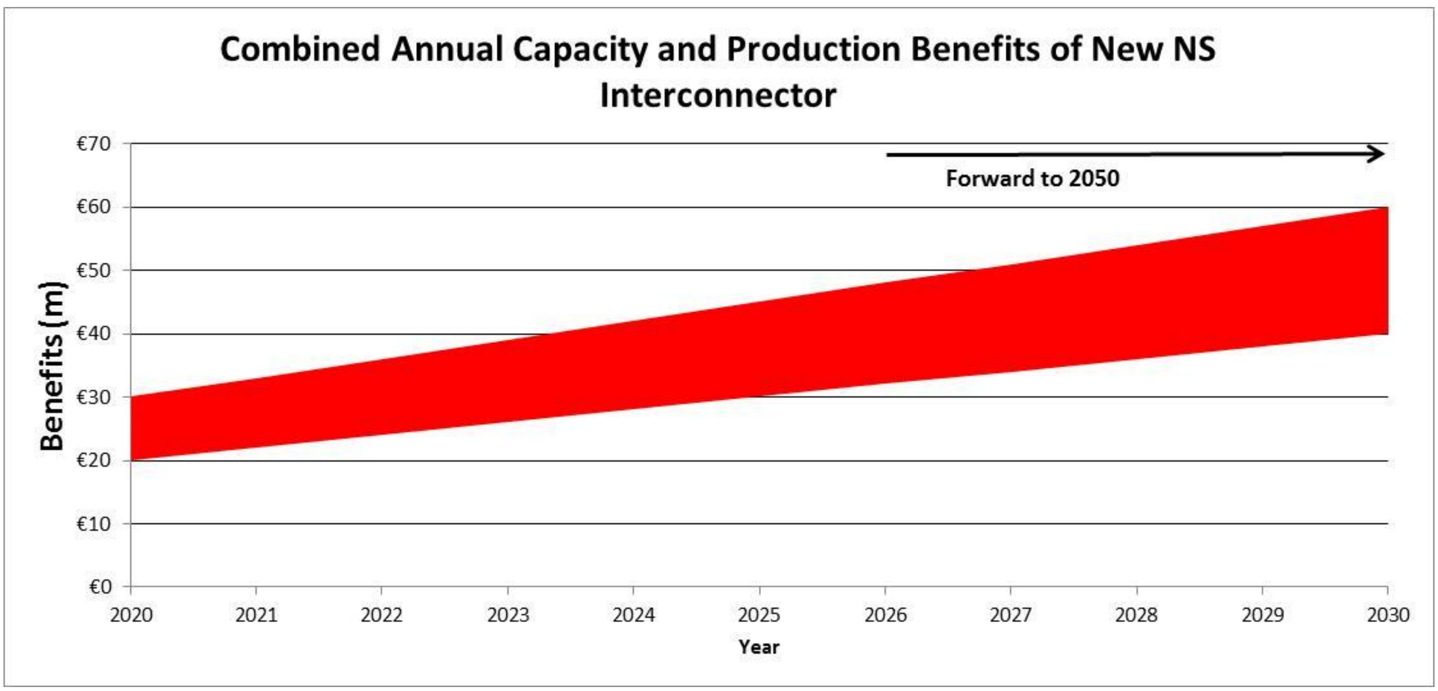

Figure 3: Combined security of supply and production cost benefits of the second North-South interconnector.