System Operator for Northern Ireland

TRANSMISSION SEVEN YEAR CAPACITY STATEMENT

2006/07 - 2012/13

FOREWORD

The Transmission Seven Year Statement is required to comply with the Transmission and Public Electricity Supply Licence issued under the Electricity (Northern Ireland) Order 1992.

This is the ninth publication of the Statement, the first having been issued in March 1993.

This document is posted on the SONI internet subject to final approval by NIAER.

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For the years 2006/07 to 2012/13

October 2006

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SYSTEM OPERATOR FOR NORTHERN IRELAND LTD

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EXECUTIVE SUMMARY

SONI has prepared the Transmission Capacity Statement in accordance with Part IIIC, Condition 11 of the Transmission and Public Electricity Supply Licence issued under the Electricity (Northern Ireland) Order 1992. There is a requirement to produce the Statement annually unless NIAER approves a derogation. The last Statement was published in December 2004 and covered the period 2003/04 to 2009/10. NIAER had then approved a derogation and therefore there was no need to provide a Statement in the intervening period. This Statement therefore covers the period 2006/07-2012/13.

The introduction of support mechanisms and government targets for renewable energy has resulted in increasing levels of wind generation. In pursuit of the target agreed under the Kyoto Protocol, the UK Government has set an obligation on Northern Ireland to derive 6.3% of its energy requirements from renewable sources by March 2013. Aspirational targets of 10% by 2012 and 20% by 2020 have also been set. This is taken into account in the additional load flows provided in this statement.

The introduction of the Single Electricity Market in November 2007 and the additional interconnection in 2012 are designed to create a climate for investment in generation capacity.

The Statement is issued to inform existing and potential users of the system of opportunities to connect to the system and to identify emerging system constraints.

The analysis underpinning this Statement involves a large number of high level studies. This Statement provides guidance only and more detailed studies would be necessary as part of any connection process. The high level load flow studies show that the areas of Islandmagee in the east of the province and the northwest cannot accommodate major generation connections. In other areas there is scope for generation connection without major system development. However, as the flows on the network increase due to load growth and transit flows from Great Britain to Northern Ireland and Republic of Ireland via the interconnectors, there will be a requirement to support the voltage during certain circuit outage conditions.

Connection of additional load is possible in many places but there may be pockets of local system congestion depending on the size of load.

Load flows with 600MW of wind farm power station capacity in 2012/13 are included in this statement. These load flows are intended to provide an indication of the system normal flows with high levels of wind generation. However, studies are underway to assess the operational impact that arises as a result of the uncertainty and variability of high levels of wind generation.

Fault level studies have been performed to a more rigorous standard and this has concluded that there are a number of high fault levels that need to be managed pending a programme of equipment replacement scheduled within the period 2007-12. With further interconnection in 2012 additional generation capacity may result in plant approaching fault levels limits. Detailed fault level studies form part of the analysis undertaken during any connection process.

There are no significant stability issues on the NI transmission system. It is necessary, however, to limit the transfer between NI and RoI to avoid stability problems arising from system separation i.e. the loss of the 275kV double circuit interconnector.

1. INTRODUCTION

This Transmission Seven Year Capacity Statement has been prepared by System Operator for Northern Ireland Ltd. (SONI) in accordance with Part IIIC, Condition 11, of the Transmission and Public Electricity Supply Licence Document issued under the Electricity (Northern Ireland) Order 1992.

SONI is responsible for the safe, secure and efficient operation of the Northern Ireland transmission network. The network is operated at 275kV and 110kV. Its primary purpose is to transport power via overhead lines and cables from generators to Bulk Supply Points (BSPs). The power is then transformed to lower voltages and distributed to customers.

This Statement describes the statutory operational requirements, the existing network infrastructure, its configuration and its planned development over the seven year period to 2012/13. Network utilisation is reported under normal operating conditions. Potential locations for large generation or demand connections are analysed and the impact of network outages resulting from planned and unplanned outages considered.

The Statement provides information on electricity demand forecasts, the transmission network, generation capacity and interconnection. Sufficient detailed modelling parameters are provided to facilitate analysis by third parties.

Outline of Statement

Section 2 states the technical requirements of the supply system and the Licence Standards which apply. System reliability, stability and quality of supply are discussed and the impact of increased penetration of wind generation and interconnection are considered.

Section 3, 4 and 5 describe the existing transmission system, interconnection and generation capacity respectively. They include an assessment of the existing system and the impact of future developments.

Section 6 provides network data including demand forecasts and plant electrical parameters.

The capacity of the transmission network is described in network load flow diagrams in Section 7 for the years 2006/07 and 2012/13 and network fault levels are included in Section 8.

The capability of the network is analysed with a matrix study in Section 9 which examines potential locations for large generation and demand connections.

Section 10 is a review of the development opportunities that exist for generation and demand customers.

Potential users of the transmission system should also be aware of the following main documents:

i) the NIE Grid Code,
ii) Licence Standards – the Transmission and Distribution System Security and Planning Standards,
iii) the Statement of Charges for Connection to Northern Ireland Electricity plc Electricity Transmission and Distribution System,
iv) the Statement of Charges for Use of the Northern Ireland Electricity plc Electricity Transmission and Distribution System,
v) the Bulk Supply Tariff, and
vi) the 2005 Generation Seven Year Capacity Statement.

Copies of the above documents may be obtained from SONI on payment of a fee or downloaded from the SONI website www.soni.ltd.uk.

This Statement does not assess the generation adequacy in NI. This assessment is undertaken separately and reported in the Generation Seven Year Capacity Statement detailed above.

Purpose of Statement

The purpose of the Statement is to provide:

a) such further information as shall be reasonably necessary to enable any person seeking use of system to identify and evaluate the opportunities available when connecting to and making use of the system including information on the status of transmission capacity and the anticipated future requirements of transmission capacity;
b) a commentary prepared by the transmission system operator indicating the transmission system operator's views as to those parts of the transmission system most suited to either new generation or new demand connections and the capability of the system to transport further quantities of electricity.

The major changes to the network highlighted since the last Statement are the introduction of:

a) increased numbers of wind farm power stations;
b) a further interconnection with RoI in 2012 planned to operate at 400kV;

c) the method of connection of the new 275/110kV bulk supply point (BSP) near Dungannon;
d) the establishment of a new 110/33kV BSP at Derrylin Co. Fermanagh to facilitate;

    - the demand for electricity as a result of industrial growth, and
    - electricity generated from wind;

Since the last Statement, work at Newtownards and Creagh BSP's is now complete, as is the uprating of the Coolkeeragh-Strabane 110kV circuit.

The introduction of the Single Electricity Market in 2007 and the additional interconnection in 2012 are designed to create a climate for investment in generation capacity.

In particular, the increasing numbers of wind farm power stations reflects the support mechanisms and targets/obligations that are in place and the statement includes power flows with high levels of wind generation.

2. MAIN TECHNICAL REQUIREMENTS OF THE SUPPLY SYSTEM

It is important for customers proposing to connect to the transmission system to be aware that there are technical requirements and standards to which the system is developed and operated.

The development and operation of the transmission system must be managed to provide safe, secure and economic supplies of electricity at a satisfactory level of quality.

2.1 Security and Planning Standards

The ability to supply customers during circuit outages is governed by the Security and Planning Standard P2/5, as amended on 7 August 1992. The standard is complex but generally requires that the main transmission system will continue to supply all customers in the event of a single unexpected event during winter. In other seasons, the system should supply all or a defined percentage of load for an unexpected event during the maintenance of another circuit. The standard applies increasing security requirements as the effected demand increases. In Section 9 of this Statement a tower failure at 275kV is considered to be a single event i.e. the outage of two 275kV circuits on the same tower. This is to ensure that the system does not suffer catastrophic failure.

2.2 Electricity Supply Regulations (Northern Ireland)

The two most important technical characteristics that determine the quality of supply are frequency and voltage. The Electricity Supply Regulations (Northern Ireland) 1991 set out the statutory obligations in relation to both frequency and voltage.

2.2.1 Frequency

The declared frequency is 50Hz and is normally controlled within the range 49.5Hz to 50.5Hz.

Balancing generation and demand maintains the frequency within the above range. The NI-RoI interconnected system is not synchronously interconnected with the UK and greater European network and thus remains an ‘island system’; as a result, the loss of a large generating unit could cause the frequency to fall below 49.5Hz for a few seconds. In such circumstances some system load may be shed automatically to assist in recovery of the frequency.

The interconnection of the NI system with the RoI system, via the Tandragee/Louth 275/220kV double circuit interconnector and two power flow controlled 110kV interconnectors, increases the inertia of the system. Under these circumstances, the loss of a generating unit impacts less severely than when the NI system was isolated. Nevertheless, the loss of generation may in some circumstances still result in under-frequency load shedding.

SONI has negotiated with Moyle Interconnector Ltd and National Grid Electricity Transmission (NGET) to use the Moyle interconnector to contract for the provision of spinning reserve. This will be introduced in 2007 to provide a reliable source for reserve and displace reserve provided by conventional generation.

2.2.2 Voltage

The voltage variation permitted (Electricity Supply Regulations NI) on the NI 275/110kV transmission system is $\pm$ 10% at the terminal of a customer.

The permitted step voltage changes are specified in the Transmission and Distribution System Security Planning Standards (PLM-ST-9).

The permitted step voltage changes are described below:

a) For secured single circuit outage - not greater than 6%
b) For secured double circuit outage - not greater than 10%.

For conditions a) and b) the 110kV voltage at BSPs should not drop below 90%.

The voltage at any point on the system is determined by the reactive power output of the generating plant, the tap position of each generator transformer and system transformer, the electrical characteristics of the system, and the level of load and its power factor. Voltage control is affected by providing automatic/manual control of the generator output voltage, altering transformer tap positions, and the switching of shunt reactors or capacitors. These operational measures do not compromise the security standards imposed by the NIE Licence.

2.3 Grid Code Requirements

The main technical conditions to be met by users of the system are outlined in the NIE Grid Code. The Code sets out the principles governing NIE's relationship with users of the system. The Code specifies procedures for both planning and operation and covers both normal and exceptional circumstances.

The main sections of the Code are as follows:

Planning Code
Connection Conditions
Operating Codes
Scheduling & Despatch Codes
Data Registration Code
General Conditions
Metering Code

2.4 Licence (System Security and Planning) Standards

The system is planned in accordance with the document entitled "Transmission and Distribution System Security and Planning Standards" which has been approved by NIAER. The relevant standards applicable to the NI Transmission System are described in Table 12.

The regulators and the relevant government departments in NI and RoI (DETI and DCMNR) have placed an action on both NIE and EirGrid under the All-island Energy Market Development Framework issued in June 2004 to determine to what extent Grid Codes and Licence Standards can be harmonised within the two jurisdictions.

2.5 System Reliability, Stability and Quality

2.5.1 Overall

The system is planned in accordance with the Licence Standards (see Section 2.4) where particular consideration is given to avoiding potential problems due to forced circuit outages occurring during a planned circuit outage. The location and connection arrangement of power sources is very important in this context.

As well as considering the reliability of circuits and load flows following circuit outages (overload situations), it is necessary to consider the stability of the system. When proposals for new generation or demand connections or interconnection are being considered it is necessary to investigate transient stability (the resilience of the system to faults) and dynamic stability (resilience of the system to generator trips or circuit switching).

System instability can usually be prevented by the application of enhanced protection and control systems. Instability can result in loss of synchronism between generators; consequential tripping of circuits, mismatched pockets of generation and load, loss of supply and possible plant damage.

Having regard to the relatively small size of the system, it is also necessary to consider the adequacy of the response characteristics of generating units.

2.5.2 Increased Penetration of Wind Farm Power Stations

Wind power generators, have characteristics which differ from those of fossil fuel generators. In particular:

i) the energy source may be uncertain,
ii) the performance during and after faults may be difficult to control,
iii) the delivery of ancillary services may require attention, and
iv) system inertia may be reduced because large fossil fuel generators are not running

SONI has introduced systems to reduce the uncertainty in energy availability (e.g. Anemos[1] forecasting) and to help manage residual uncertainty and variability.

The NIE Grid Code has been modified to place duties on wind generators in respect of ii) and iii) above. It is likely that in order to facilitate high penetration of wind power, obligations will be required for wind generators to contribute to system inertia (see iv) above).

2.5.3 Interconnection with GB

The 500MW HVDC link with GB is described in Section 6.0

HVDC links have an advantage over alternating current interconnection in that separate control of voltage and frequency can be maintained on each system. The power flow can be preset at a fixed value and in an emergency the link can provide additional support through its very rapid automatic response to system disturbances.

Where there are faults on the NI system effects are limited to a brief distortion of its 50Hz AC synchronous waveform, in import mode. The rapid response means that the HVDC link can have a net stabilising effect on the island system in the event of generation loss. None the less, in so far as it displaces rotating plant, the HVDC link reduces system inertia.

[1]SONI is a participant in the Anemos project. This is a collaborative effort between wind developers, manufactures, utilities and academia to develop system operator tools to better manage high levels of wind penetration

Similarly an emergency action programme can immediately reduce import from GB or increase output to GB upon a sudden loss of load, or the loss interconnection with RoI. This prevents severe over-frequency and subsequent plant trips.

3. THE NI TRANSMISSION SYSTEM

The purpose of this section is to describe the topology of the NI transmission system. Large generation and demand connection projects tend to have long lead in times. It is necessary to consider future planned network developments, which may alter the configuration of the system during the connection project.

3.1 The Existing System

The NI transmission system comprises some 2,000 circuit kilometres of 110kV and 275kV overhead lines and cable. The backbone of the transmission network in NI was originally built to a high standard with the potential to deal with many years of load growth in NI. A geographic layout of the existing transmission system is shown in Map 1.

3.2 The Future Planned System – Developments Approved

As of 1 January 2007 system developments which have been approved by NIE for completion during the course of the seven year period are as follows:

3.2.1 275/110kV Drumkee Substation - Phase 1

Initially a new 275/110kV single 240MVA transformer substation is to be located close to the 275kV tower line and will supply Dungannon BSP by a new 110kV circuit. A previous Statement envisaged a 120MVA transformer. This has now been revised in response to anticipated future growth in demand. Work is proceeding; it is estimated that the substation will be commissioned by spring 2008.

3.2.2 Coleraine capacitor

48MVAr of 110kV connected capacitive support will be installed at Coleraine BSP in spring 2007. This is a mechanically switched capacitor unit. The increased number of wind farm power stations connected to the system in this area will benefit from the voltage support provided by the capacitor. It will also support the voltage during a variety of outage conditions.

3.2.3 Kells-Coleraine 110kV circuit

The network in the northwest is heavily loaded and the window for scheduling circuit outages is now very small. To address this problem the first section of the Kells-Coleraine 110kV circuit will be uprated leaving the whole circuit winter rating as capable of 124MVA (currently 103MVA). It is expected that this work will be completed before winter 2008.

3.2.4 Gortmullan 110/33kV BSP

The establishment of a new 110/33kV BSP at Derrylin is to facilitate both growth in demand from industrial customers and the connection of further wind farm power stations in that locality.

3.2.5 Whitla Street 110/33kV BSP

The BSP at Power Station West (PSW) is to be decommissioned and replaced with a new BSP at Whitla Street in north Belfast. The two 110kV cable circuits from Hannahstown to PSW will be turned into Whitla Street which will be equipped with 2x90MVA transformers and a new 33kV switchboard. The BSP will be commissioned by 2009.

3.2.6 Springtown 110/33kV BSP

The existing 33kV circuits supplying the Springtown 33/11kV substation are approaching their thermal limits. The 33kV circuits will be upgraded to 110kV and a new 110kV BSP will be established. It will be equipped with 2x90MVA transformers and a new 33kV switchboard. The BSP will be commissioned by 2009/10.

A geographic layout of the system highlighting the above developments, where appropriate, is shown in Map 2.

3.3 The Future Planned System – Developments Unapproved

3.3.1 A 400kV interconnector with RoI

It is planned to establish by 2012 further interconnection with RoI. Plans are at an advanced stage but the precise terminal locations have yet to be decided. However, it is expected that the terminal locations will be in the vicinity of Dungannon, Co. Tyrone, in Northern Ireland and mid-Cavan in the Republic of Ireland. This will support the existing interconnector and also facilitate increased transfer capacity into the future. The 'Tyrone to Cavan interconnection fact sheet' (May 2006), available on the SONI website at www.soni.ltd.uk, can be referred to for further information.

3.3.2 Miscellaneous projects

Works have been identified to replace assets and address load flow issues during the period April 2007 to 2012. Various schemes such as transformer replacement and circuit enhancement have been identified for progress during the period from April 2007 to March 2012. For the purposes of this Statement, certain projects have been assumed as being approved.

3.3.3 275/110kV Drumkee Substation - Phase 2

The second and final phase will involve the installation of a second 275/110kV 240MVA transformer. This will be accompanied by 110kV circuit reconfiguration. The 110kV mesh at Dungannon BSP will be removed and reconfigured to create two 110kV transformer feeders. This work is planned to occur around 2012 in the early years of the next regulatory review period (RP5). Other 110kV circuits in the locality may be reconfigured to optimise the system performance.

For the purposes of this Statement projects have been included that are identified in 3.3.1 and 3.3.2 but not 3.3.3 as this project is unlikely to be completed within the years covered by this document.

3.4 Special Protection Schemes

Special protection schemes involve monitoring the network, and taking automatic action to minimise network problems when unexpected events occur. For example, the schemes may detect low network voltages, circuit overloads or circuits tripping and eliminate network problems by reconfiguring the network or changing the output of generation. The design of individual schemes determines how they effect network operation in specific parts of the network listed below.

3.4.1 110kV Circuit Protection scheme Tandragee-Drumnakelly-Dungannon.

Under certain 110kV circuit outage scenarios the Tandragee – Drumnakelly circuits can be significantly overloaded. To relieve this situation a special protection scheme has been installed involving a combination of tripping certain circuits and load shedding measures.

3.4.2 Coolkeeragh Under Voltage Scheme

At peak load times when there is insufficient operational generation at Coolkeeragh, there may be under-voltage conditions in the North West during a forced outage on the Magherafelt to Coolkeeragh 275kV double circuit. To relieve this situation a special protection scheme has been installed involving load-shedding measures.

3.4.3 Coolkeeragh Generation Curtailment Scheme

If the Coolkeeragh CCGT (and OCGT) is operating at high output at times of low NI load and an outage on the Magherafelt to Coolkeeragh 275kV double circuit occurs, the 110kV local circuits could overload. Under these rare circumstances the CCGT output will be automatically curtailed (to about 160MW).

3.4.4 Ballylumford Generation Curtailment Scheme

In the 2001 Transmission Seven Year Capacity Statement it was stated that no more generation could be absorbed on Islandmagee. Since then, an arrangement was been made to allow RoI generation capacity shortage to be relieved by utilising a generator, which was otherwise due to be retired at Ballylumford. This could only be managed on a disconnectable basis, as agreed by the parties. When an outage occurs on either Ballylumford 275kV circuits, causing an overload condition to arise, then the unit supplying the RoI would be tripped. This arrangement with RoI has expired but the unit remains available to support the NI demand on the basis of the curtailment scheme.

3.4.5 Wind Powered Generation

Several wind powered stations have arrangements to optimise their use of the system while maintaining network loading and voltage within acceptable limits under abnormal conditions. Whilst wind farms have generally been connected to the 33kV sub-transmission system the level of penetration is now impacting on the operation of the transmission system. Current analysis indicates that the system is capable of catering for circa 400MW of wind farm capacity before thermal limits are exceeded.

4. INTERCONNECTION

The level of imports or exports on interconnectors greatly influences power flows of the NI transmission network. The recovery of the system under fault conditions, as a result of generation or network losses, is heavily dependent on interconnector flows and transits to RoI or GB. This section describes the interconnector capabilities and future plans for further interconnection.

4.1 Existing Interconnection

4.1.1 275kV Tandragee – Louth (RoI) Interconnector

The NI transmission system was re-connected with RoI in March 1995. The interconnection is via a double circuit 275kV line between Tandragee and Louth terminated in two paralleled 300MVA 275/220kV transformers on one circuit, and a 600MVA 275/220kV transformer on the other.

The 275/220kV interconnection provides the opportunity to share 'spinning reserve' and trade energy between the two systems.

The physical firm capacity of the Tandrageee – Louth interconnector plant is assessed as the emergency overload rating of one circuit – 660MVA summer rating. However the configuration of the interconnected systems generally imposes more severe restrictions. A significant limit is set by the ability of the systems to cope with system separation that results from a forced outage of the interconnector. At present the tradeable capacity is limited to 330MW export or 170MW import on the basis of a combination of system separation and thermal constraints.

4.1.2 110kV Interconnection

110kV interconnection with RoI is as follows:

(a) Strabane - Letterkenny 110kV circuit – a single circuit line crossing the border was commissioned in March 1995.

(b) Enniskillen - Corraclassy 110kV circuit - as above.

Until 2001 both circuits operated in a standby mode but were then converted into permanent interconnectors by the deployment of power flow controllers. The power flow controllers are rated at 125MW. The power flow controllers are normally adjusted to close to 0MW transfer but can be set to any desired flow to support either system during abnormal operation. The systems are not considered stable in the absence of 275kV interconnection and therefore the 110kV interconnectors are automatically removed from service in the absence of both 275kV interconnector circuits. In the event of a severe outage e.g. Coolkeeragh-Magherafelt 275kV double circuit, the power flow controllers allow immediate support from the healthy system to remain, pending manual control action.

4.1.3 Interconnection with GB

The Moyle interconnector, Northern Ireland - GB, commenced commercial operation in 2002 and is constructed as a dual monopole HVDC Link with two coaxial undersea cables from Ballycronan More, Islandmagee, Co. Antrim, to Auchencrosh, Ayrshire, Scotland. The link has a physical installed capacity of 500MW. The present system constrains the GB to NI tradable capacity to 400MW (under emergency conditions this can be increased to 450MW). The converter station at Ballycronan More has been looped into one of the 275kV Ballylumford to Hannahstown circuits.

4.2 Future Interconnection Development

NIE and Eirgrid have been exploring the potential for additional interconnection. The primary object is to further increase the transfer capability to facilitate higher unconstrained flows between the two systems. 400kV, 275kV and 110kV options were considered. As a result of system studies, NIE and Eirgrid are together proceeding with Planning Applications for an additional interconnector to operate at 400kV. The project plan defines delivery of the interconnector in 2012. Internal reinforcements are needed in both systems.

4.3 Use of Interconnection

The SONI/Eirgrid Joint Operating Panel agrees operating procedures for NI/RoI interconnectors. Under the Operation Agency Agreement with the asset owner, Moyle Interconnector Limited (‘Moyle’), SONI operates the interconnector with Scotland in conjunction with its operation of the NI transmission system. In this capacity, SONI operates the interconnector in conjunction with National Grid Electricity Transmission in the UK, and are the Interconnector Administrator and Error Administrator under the UK BETTA arrangements. Cross-border trading arrangements are in line with the EU IME Directive (concerning rules for the internal market).

4.3.1 NI-GB

The total east-west net transfer capacity (NTC) of the Moyle interconnector is as follows (‘winter’ meaning November to March and ‘summer’ meaning April to October):

- Winter 400MW
- Summer day 400MW
- Summer night 300 MW

There is a priority reservation of 125MW until late 2007 for the Capacity Agreement between Moyle and the NIE Power Procurement Business (PPB), which was an integral part of the agreement between NIE and Scottish Power under which the Moyle Interconnector was built.
Annual and monthly auctions are administered by SONI on behalf of Moyle Interconnector Ltd to facilitate capacity purchases of the remaining 275MW (175MW on summer nights) of the NTC. A similar arrangement exists for the purchase of the 80 MW of West-East capacity.

4.3.2 NI – RoI

The capacity on the Tandragee - Louth 275/220kV interconnector is auctioned annually and monthly. These auctions are administered by SONI on behalf of NIE for north-south capacity. Of the current maximum 330MW net transfer capacity in the north-south direction, 280MW can be purchased in the annual auction and up to 50MW reserved for monthly auction. EirGrid are responsible for the sale of the net transfer capacity in the south-north direction, which is currently 170MW.

Superposition was introduced in 2003 to further facilitate trades. A trader wishing to transit RoI – NI may nominate and will be guaranteed transit if linked to an NI – RoI trade (providing NI – RoI is the dominant flow). Other RoI – NI nominations may also be allowed, but are not automatic. This ‘netting-off’ of trades allows further NI – RoI trades to take place.

Interconnection with Scotland and RoI offers opportunities to transfer power in either direction. The level of transit flows takes account of all operational aspects such as the impact factor on the NI or combined NI/RoI system and commercial aspects such as the cost resulting from any redistribution of spinning reserve. The ability to transit flows to RoI, especially at times of low indigenous NI load, is related to the ability to control frequency in the event of loss of interconnection. This is now managed in part, by a rapid reduction facility on the Moyle interconnector to reduce the import into NI and prevent conventional generation attempting to counter the high system frequency.

5. EXISTING GENERATION

This section of the Statement provides details of the generators connected to the transmission system and also smaller capacity generators embedded in the distribution system. The expected increase in wind farm power station capacity will have a large impact on the operation and planning of the transmission system in the next seven year period. It is important to understand the NI generation portfolio and how system operating characteristics are likely to change in the period covered by this Statement.

For a detailed generation adequacy analysis SONI publish the Generation Seven Year Capacity Statement. This is available on the SONI website www.soni.ltd.uk.

5.1 Generation Capacity Agreements

5.1.1 Capacity Contracted to NIE through Power Purchasing Agreements (PPA's)

Plant contracted to NIE under pre-vesting contracts or contracts negotiated thereafter totals to a maximum of 1,718MW, measured as output capacity at generator terminals (see Table 1). All of this capacity is assumed to remain committed for the duration of the period covered by this Statement.

These contracts contain expiry dates, though NIAER may cancel contracts at earlier cancellation dates. The PPAs or Generating Unit Agreements cover availability, operating characteristics, payments, metering etc. Power Station Agreements cover matters such as outage planning, emissions, and fuel stocks.

5.1.2 Independent Power Producer (IPP) Generation Capacity

NIAER has a duty to promote competition in the generation and supply of electricity. Competition in wholesale electricity trading, in line with the EU IME Directive (concerning common rules for the internal market in electricity 2003/54/EC), was introduced in July 1999. The Moyle interconnector and the Coolkeeragh CCGT are currently the main facilitators of IPP capacity. Table 1A provides a complete list of contracted and IPP generators connected to the NI transmission system.

Each generator wishing to participate in wholesale electricity trading must enter into a System Support Services Agreement (SSSA) with the transmission system operator (SONI). This Agreement covers items such as black start, operating characteristics, outage planning, and the provision of system support services. IPPs also pay a transmission use of system tariff

(TUOS) to NIE.

Market opening now encompasses all non-domestic customers, which will account for approximately 60% of total energy sales. The market is to be fully opened for all customers during 2007.

5.2 Renewable Generation

5.2.1 Non-Fossil Fuel Obligation (NFFO) Capacity

Under the Non-Fossil Fuel Obligation (NFFO), NIE signed contracts for approximately 15MW DNC (Declared Net Capacity) of Non-Fossil Fuel Plant on 1 April 1994 (NFFO1) and 3MW DNC a short period later (NFFO2). The commissioned schemes are shown in the Table 1B and these contracts will expire from 31 March 2009. However, for the purposes of this Statement, it is assumed all the plant will remain available until at least 2012 (although it may be that some of the wind generators will be re-powered with larger turbines).

5.2.2 Additional Renewable Generation

Table 1C lists the independent wind powered generation schemes totalling some 84MW that have been connected to the NI network.

Table 1D lists the independent wind generation schemes that have been approved for development at the time of publishing this Statement. Wind powered generating units are generally connected to the distribution network (33kV and 11kV) and network analysis/design takes into consideration the variability of this source of energy.

5.3 Customer Private Generation

A number of customers have been reducing energy consumption at times of peak demand times by load shifting or by running private generation. NIE has tended to view this generation as non-permanent due to a number of factors;

a) the operation of this plant is not as reliable as conventional contracted plant;
b) variable generation costs (diesel/hire charges); and
c) variable tariff price signals.

Generation of this type is estimated to total 132MW. If and when embedded generation levels increase, a probabilistic approach will be developed to determine the reliance that can be placed on embedded generation. NIE also plans to examine Table 2 in licence standard P2/5[2] to allow greater distribution system reliance to be placed on embedded generation. This in turn affects the expected demand at transmission BSPs.

5.4 Generation Operation

The scheduling of generation to meet demand is carried out with the nominated IPP generation dispatched first and the remaining capacity on a merit order cost basis. Low marginal cost plant will be called before high marginal cost plant and any spare IPP capacity will be taken on an economic basis. An exception to this rule can occur in respect of scheduled outages of transmission circuits for major construction projects, refurbishment and/or maintenance. Further exceptions to the rule can occur in respect of government imposed limitations on power station flue gas emissions. The schedule and dispatch of generation will be undertaken on an all-island basis to meet the requirements of the SEM from November 2007.

5.5 Spinning Reserve - Load shedding

When isolated, the NI system is operated with a minimum of four generating units carrying spinning reserve covering at least 68% of the largest infeed to the system. For a sudden loss of generation the balance is restored by shedding load via a low frequency selective tripping scheme. Should one generating unit trip the remaining three provide the spinning reserve cover as above and load shedding may take place. The 275/220kV Tandragee - Louth interconnector enables spinning reserve to be shared between the NI and ROI systems. The total combined system spinning reserve requirement is based on 75% of the largest island infeed. The allocation of sharing spinning reserve is kept under review to maintain an optimal economic and secure operation of the combined systems. Currently NI provides no less than one third of the total spinning reserve requirement. NI can operate with a minimum of three generating units when interconnected. Studies have confirmed that this is sufficient to maintain stability under system separation conditions.

[2] This has been updated in GB to adopt Engineering Recommendation (“ER”) P2/6 as part of their Distribution

6. TRANSMISSION SYSTEM DATA

This section of the report describes the base data upon which the analysis in this Statement is based. It describes in detail the demand forecast and electrical system parameters necessary to complete load flow studies on the NI transmission network. The Statement includes the data sets of electrical parameters to facilitate system load flow studies to be carried out by third parties.

6.1 Forecast of System Maximum Demand

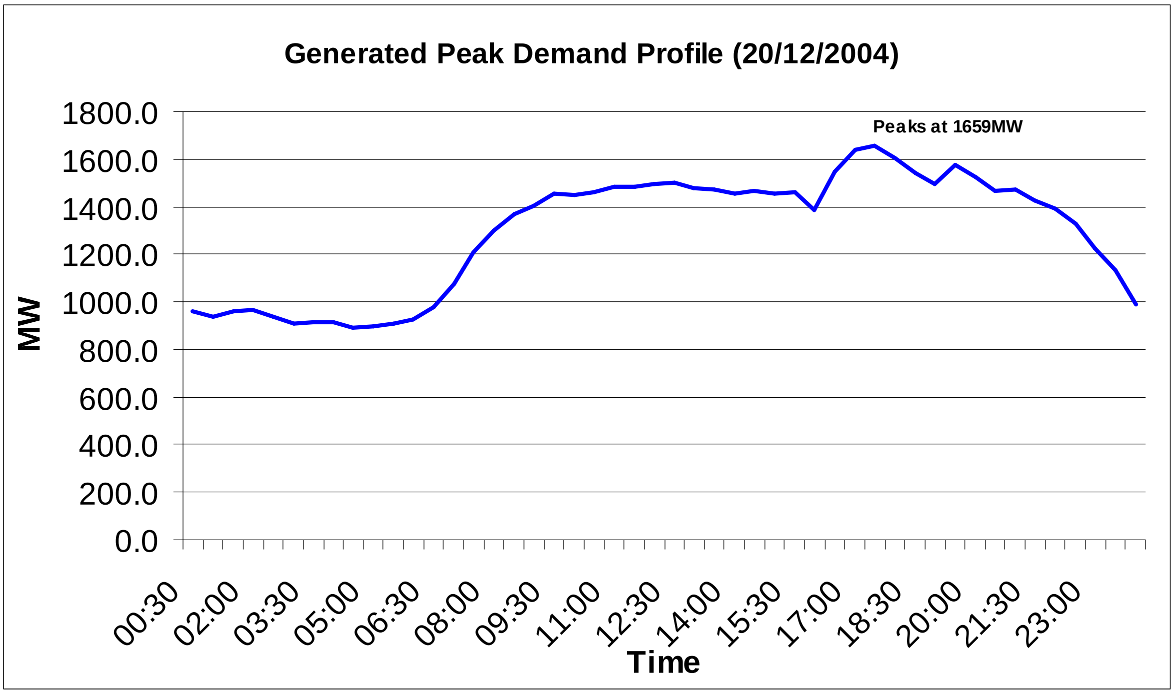
The system maximum demand data is based on totalised data from power stations, interconnectors, NFFO and other renewable generators, and customer private generators.

Temperature has been found to have the greatest effect on demand compared with other meteorological factors. Temperature correction in the form of an average cold spell (ACS) analysis is necessary to remove the demand variation caused by temperature, thus enabling the underlying demand growth-rate to be determined more accurately.

6.1.1 System Maximum Demand

The actual 2004/05 NI system peak demand was 1791MW (1616MW centrally despatched, NFFO and other renewable generation 43MW, and customer private generation 132MW) and occurred on Monday 20 December 2004 at 17.20hrs. When adjusted to Average Cold Spell (ACS) conditions the peak demand was determined to be 1801MW.

The generated profile including NFFO and other renewable generation for the Monday 20 December 2004 is shown in the demand profile graphed below. This maximum demand is as a result of coincidental usage patterns, for example domestic cooking load and lighting load. The profile graphed below does not include the demand that was suppressed by customer private generation (approx. 132MW). At a nodal level, it is difficult to define a simple relationship between winter and summer daily load patterns. At some nodes, the summer peaks appear early in the day whereas others continue to occur around the evening mealtime. This variance is the result of the mix of commercial, industrial, and domestic load at a particular node.



6.1.2 System Maximum Demand Forecast

The actual 2005/06 NI system peak demand was 1851MW and occurred on Tuesday 13 December at 17.15hrs is 1874MW adjusted to ACS.

The forecast, detailed in the table below, used in this Statement is based on data up to and including the 2004/05 winter period and is corrected for ACS conditions.

2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
1861	**1889**	**1918**	**1947**	**1977**	**2007**	**2037**

Note: The load suppression caused by customer private generation (Section 7.4) is not subtracted from the figures listed above, whereas the Generation Seven Year Capacity Statement is net of private generation.

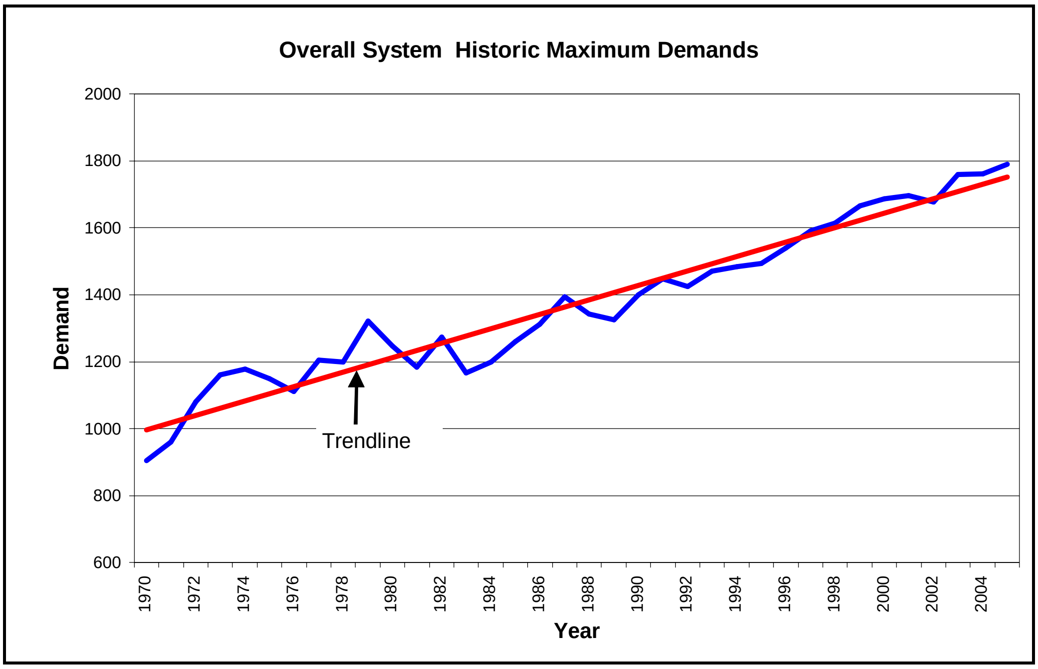
The forecast employs a deterministic approach; statistical regression analysis is used to analyse historic data and forecast future trends. It is important to compare these results with economic indicators and the general outlook for the NI economy.

The numbers of employee jobs in the construction and service sectors in NI have continued to grow; whilst the manufacturing sector has continued to decline. Manufacturing productivity has shown an upward trend in recent years with manufacturing output remaining stable despite falling employment in the sector.

There is a possibility that next year's UK comprehensive spending review may result in some additional resources becoming available but the overall outlook to 2010 is for very modest growth. Higher energy bills, property revaluation, university top-up fees and phasing in of water charges early next year, will affect consumer spending. The outlook for industrial output remains somewhat mixed and is contingent upon an upturn in the national economy. (September 2006 – First Trust Economic Outlook).

The overall network demand growth predictions are reduced from growth rates in excess of 2% in the late nineties to a current prediction of 1.6%. NIE demand predictions take into consideration exogenous factors such as the impact of natural gas and energy efficiency initiatives.

The graph below plots historic system peak demands for the past 36 years. Demand growth has been steady throughout this period, although it is perhaps significant that for the last 8 years the trend line has been, in the main, exceeded.



6.2 110/33kV Bulk Supply Point (BSP) Demand

The BSP installed transformer capacity, substation firm capacity, and predicted demands are given in Table 2.1. Those substations in which the

firm capacities are exceeded are highlighted (notes indicate how this will be managed). The geographical location and connectivity of the BSPs can be determined from Map 1 and Map 2.
NIE has developed plans to ensure compliance with licence standards, for example: to increase substation firm capacity; to obtain load relief and/or voltage support through commissioning new BSPs (such as Drumkee); or to carry out small amounts of load shedding as is permitted in licence standards.

Developments that have been approved are described in Section 3.2 and those that are unapproved at this stage but are expected to proceed are described in Section 3.3.

Table 2.2 indicates available capacity at each BSP. This Table is drafted on the basis of not extending load shedding and has been introduced to assist network users in assessing connection opportunities. It will be necessary to carry out further analysis depending on the magnitude and type of load to be connected, to establish if a connection is viable.

6.3 Busbar Data

The data for base year 06/07 is given in Table 3. The data comprises the node definition, voltage, active and reactive load.

6.4 Circuit Capacities and Parameters

The continuous thermal rating of a circuit is the maximum power flow that can be passed through the circuit on a continuous basis. On overhead lines, the circuit rating ensures that conductor sag does not infringe statutory clearances and that circuit damage is avoided. The thermal rating varies for each season of the year, due to the impact of differing climatic conditions on equipment performance. The data for the base year 06/07 is given in Table 4. The data comprises the identification information, resistance, reactance, susceptance and seasonal continuous ratings of overhead line and cable circuits. Table 5 provides the data for changes to the system over the seven-year period. There may be instances where protection system characteristics produce a further limitation.

6.5 Transformer Data

BSP, interconnector, and generator transformer data for the base year 06/07 is provided in Table 6. The data comprises the transformer upper and lower tapping ratios, the number of tap steps, resistance, reactance and ratings. The ratings are maximum continuous values and do not allow for short-term enhancement. Table 7 indicates transformers that have been added over the seven-year period.

6.6 275/110kV Interbus Transformer and Capacitor Data

The interbus transformer data is displayed in Table 8. This comprises the transformer upper and lower tapping ratios, the number of tap steps, winding resistance/reactance, and rating information. Interbus transformers added to the system over the seven-year period are also indicated. Table 9 also highlights the location, voltage level, and the magnitude of installed fixed capacitance. The operation of this equipment will be variable and dependant on network operating conditions, configuration, etc.

7. TRANSMISSION SYSTEM POWER FLOWS

The power flows are represented on schematic diagrams of the NI Transmission system (Figures 1-11). They are the method by which results of load flow analysis are best displayed. They provide a broad view of the system as it develops over a seven year period and also display seasonal loading conditions. The power flows are an important guide when assessing system capacity and possible locations for connection.

7.1 Introduction to the Power Flows

The previous sections have described the background to the NI transmission system and the manner in which it is designed and operated. This section of the report deals with the results of system studies for the forthcoming seven-year period.

Power flows on the NI transmission system are provided for 2006/07 and 2012/13 to give a broad view of the system as it develops.

The power flows are displayed in schematic diagram format in a series of Figures as follows:

a) Figures 1 – 2 busbar layouts year 2006/07 and year 20012/13,
b) Figures 3 – 5 system load flows for summer, autumn and winter 2006/07,
c) Figures 6 – 8 system load flows for summer, autumn and winter 2012/13, and
d) Figures 9 – 11 system load flows for summer, autumn and winter 2012/13 with 600MW of wind generation.

The report provides detailed information on the way in which system developments impact on the load flows. Figures 9 – 11, include high levels of wind generation and are a new addition to this Statement.

In any one year, the power flows on the transmission system vary on a seasonal basis with varying demand and with a changing generation profile. To give an appreciation of the effect of these different load and generation combinations, the Statement considers three representative seasonal power flows for each of the years above. The seasons and load conditions are:

a) winter, peak load condition;
b) autumn, peak load condition; and
c) summer, peak load condition.

Analysis of system demand levels has led to an assessment that summer and autumn peak load conditions equate to 69% and 75% of winter peak demand levels respectively.

The power flow studies represent normal system conditions with no transmission outages as a result of a fault or for maintenance. Some transmission circuits are run open where this is a normal running arrangement for the season being studied. The effect of fault or maintenance outages is normally assessed in Section 9 on 'Transmission System Capability'.

The changes to the transmission system used in the power flow models are those authorised projects listed in Section 3.2 and unapproved but expected reinforcements described in Sections 3.3.1 and 3.3.2.

In the power flow studies, the 110kV interconnections with RoI are assumed to run with zero power transfer in line with the normal operational practices. The 275kV Tandragee - Louth ESB interconnector is assumed to have a zero transfer in the powerflow studies. This mode of analysis provides a consistency between this assessment and EirGrid’s current edition of their Transmission Capacity Statement in which the interconnector is modelled at 0MW. It should be stated however that current system normal conditions would have the transfer at circa. 200MW, as dictated by market trading.

The Moyle Interconnector is operating throughout the period covered by the Statement with varying transfers to meet the Northern Ireland system maximum demand.

An overhead line, in common with other equipment on the transmission system, has a maximum continuous rating, which is set by the heating effect of the current passing through the circuit. For ease of interpretation the current limit is normally converted to an equivalent MVA rating. This rating varies with ambient temperature, so a given circuit will have different seasonal ratings. Some substation equipment may need to be modified or replaced to enable the full circuit rating to be achieved.

In the power flow schematics (Figures 3 to 11), the MVA flow on each circuit is shown above the line or to the left of the line, depending on line orientation. The direction of flow is indicated by the arrow. The percentage loading of a circuit is shown below the line or to the right of the line, again depending on line orientation. The figure is the MVA flow, divided by the appropriate MVA line rating for the season being studied. The percentage shown is at the seasonal rating, for example the summer peak power flow schematics show the percentages of summer ratings for each circuit. The voltage (p.u.) is displayed beside each busbar (line MVA ratings are based on a 1 p.u. voltage).

The 2006 summer through to 2007/08 winter power flow studies can utilise the 2 x 180MW sets (units G4 and G6) at Ballylumford if required to do so, after 2007/08 winter it is assumed only G4 can be utilised, as G6 will be out of contract with its future unclear. This arrangement is described in more detail in Section 5.1.1 .

In the following subsections, the power flow studies for 2006/07 and 2012/13 are discussed.

7.2 Power Flows for 2006/07

The three seasonal loadflows for 2006/07 are presented as follows:

Figure 3 - Summer Peak Flow 2006
Figure 4 - Autumn Peak Flow 2006
Figure 5 - Winter Peak Flow 2006/07

There are a number of changes in the 2006/07 base year load flow studies shown in the schematics Figures 3 – 5, when compared to the previous 2003 edition of the Transmission Seven Year Capacity Statement:

Circuit up-rating – Coolkeeragh to Strabane 110kV circuits have been refurbished to new ratings of 166MVA(Winter), 158MVA(Autumn), and 144MVA(Summer).

Line Impedances – the Creagh to Dungannon 110kV, Creagh to Kells 110kV and Coolkeeragh to Strabane 110kV circuits were reassessed by detailed modelling, with more accurate line impedances being determined for each.

Load Modelling – the load at the Glengormley busbar has been reconfigured so that it is now modelled as a split busbar as per system normal running

System Capacitors – the schematics (Figures 3-11) include mechanically switched capacitance to manage certain critical 275kV double circuit outages. Capacitance is installed at Castlereagh, Tandragee, and Coolkeeragh (48Mvar will be commissioned at Coleraine in the summer of 2007) and is either switched in or out depending on the voltage level. Most, if not all, capacitors will be switched in during winter load flows, while some may be left out in the autumn and summer load flows.

System Operating Configuration - the schematics (Figures 3-11) show the Castlereagh to Carnmoney and Ballyvallagh to Kells 110kV circuits switched in whilst the second interbus at Ballylumford is switched out. This change in configuration (from the last Statement) is necessary to reduce fault levels on the Ballylumford 110kV switchboard to below switchgear ratings. The 110kV circuits ex Ballylumford are run open when the generation export from Islandmagee exceeds a critical level of circa. 1,100MW. Previously the 110kV circuits were operated open with both interbus transformers in service.

In all three power flows, summer, autumn and winter, the transmission circuit loadings remain within circuit rating, except for Tandragee to Drumnakelly 110kV circuits whose ratings can be exceeded for some secured contingencies. A special protection scheme is in place to prevent overload of these circuits.

7.3 Power Flows for 2012/13

Seasonal load flows have been prepared to show the effects of significant developments. The three seasonal loadflows for 2012/13 are presented as follows:

Figure 6 - Summer Peak Flow 2012
Figure 7 - Autumn Peak Flow 2012
Figure 8 - Winter Peak Flow 2012/13

In addition to the changes detailed in Section 7.2 above, these load flows represent the effects of some additional future developments as described in Section 3:

Gortmullan 110/33kV Substation – A new 110/33kV substation is to be established near Derrylin in 2007. This will maintain security and quality of supply to meet the increased industrial demand, and facilitate the impact of large amounts of additional wind powered generation planned for that locality (circa. 60MW).

Drumkee 275/110kV Substation Phase 1 – The plan is to install a new 275/110kV single 240MVA transformer substation. The node will be supplied by one of the 275kV circuits from Tandragee to Magherafelt and will be physically located close to the 275kV tower line. Drumkee 275/110kV substation will supply Dungannon Main by a new single 110kV circuit. It is anticipated that the substation will be commissioned by spring 2008.

A comparison of Figure 5 (2006/07) and Figure 8 (2012/13) winter maximum files, indicates a reduction in utilisation of heavily loaded 110kV circuits feeding the west of the province (Coolkeeragh to Strabane, Tandragee to Drumnakelly, and Drumnakelly to Dungannon). It should be noted however that if one of the Enniskillen to Omagh lines tripped, the other could be overloaded if there was no significant contribution from wind generation at that time. The heavy flow on the newly installed Drumkee to Dungannon 110kV circuit should also be noted. This indicates the need for the Drumkee phase 2 project as discussed earlier in Section 3.3.

400kV Interconnector with RoI – The plan is to construct a new 400kV single circuit to Dungannon in NI and to mid-Cavan in the RoI. This Statement shows the interconnector being introduced into the new Drumkee substation (phase 1). In terms of the power flow, the effect of its introduction is negligible due to the 0MW transfer between NI and RoI (Section 7.1). Studies have shown that it is not significant whether the Drumkee substation or another nearby location forms the terminal in NI.

Again, in all three studies power flows are normal. The transmission loadings remain within circuit rating.

7.4 Power Flows for 2012/13 with 600MW of Wind Generation

Seasonal load flows have been prepared to show the effects of a significant level of wind generation in the system – 600MW, modelled in 2012/13. The three seasonal loadflows are presented as follows:

Figure 9	– 2012	Summer Peak Flow with 600MW wind
Figure 10	– 2012	Autumn Peak Flow with 600MW wind
Figure 11	– 2012/13	Winter Peak Flow with 600MW wind

Because a significant amount of the 600MW wind generation is to be located in the west of the province, there is a marked reversal in the direction of power flows in the western area. Power flows can now be seen emanating from the Enniskillen, Strabane and Omagh BSPs. In later years, during these reversed power flow conditions, there is the possibility of overloads on some of the western 110kV lines during certain contingency outages.

Section 9 of this Statement examines the effect of outages under a range of scenarios.

Several local and system wide technical issues may arise from high penetration levels of wind farm power stations. These are being investigated in NIE and by various research bodies.

8. TRANSMISSION SYSTEM FAULT LEVELS

Fault level is a measure of the electrical energy that can flow when a fault occurs on the system, for example, when an overhead circuit comes in contact with earth. The extremely high current flows experienced during a fault enable protection equipment to detect that a fault exists and take action to clear the fault. It is important that all electrical plant on the system is suitably rated and can handle these conditions until the fault is cleared. The system fault level changes as the generation profile or system configurations are modified. It is important that generation and demand connections to the transmission system are designed to cope with resulting fault levels. It is equally important to understand the effect the connection has on transmission system equipment to ensure the ratings are not exceeded.

In this Section the three phase and single phase to earth fault levels at the 275/110kV busbars on the NI transmission system are considered. Fault levels are calculated for the 2008/09 winter and displayed in Table 10.

SONI have applied the engineering recommendation (ER) G74 fault level guidelines. ER G74 sets out 'good industry practice' for computer-based methods of calculating short circuit currents to achieve higher accuracy modelling. G74 recommendations take into account: fault contributions from all synchronous and asynchronous rotating plant including induction motors embedded in the general load; the zero sequence mutual coupling on 275/110kV on double circuit towers; and the unsaturated generator reactance values. For completeness, this Statement has also included the fault level contribution from wind farms.

The fault studies have been conducted with the combined NI and RoI systems. This fully interconnected all-island model simulates fault conditions more accurately than using a NI system model solely with a single equivalent generator representing the RoI system. The fault studies are carried out using a pre-fault load flow fault current assessment technique using generator initial sub-transient reactances.

The calculated system fault levels are based on the 2008/09 Winter maximum system with typical generation in the NI system including:

Ballylumford	G4, G6, G7, G8, GT21, GT22, ST20, & GT10
Coolkeeragh	C30, & G8 (C30 – the combined GT & ST)
Kilroot	G1, G2, GT1 & GT2
Moyle	

The HVDC link is assumed to be in service in the studies, and operating with an import. The link has no significant fault level contribution. A project is underway to establish further interconnection between NI and RoI in 2012. The introduction of the Single Electricity Market in November 2007 has been designed to create a climate for investment in generation capacity. As an example, the addition of a new 400MW generator located at the Kilroot transmission node in 2012, may result in fault levels on the system exceeding plant limits at a number of transmission nodes. This would be addressed as part of the connection process.

The fault level on the NI transmission system has increased compared with previous Statements. This is mainly due to the effect of applying the G74 recommendations in these studies and by modelling wind farm contributions. The effect of applying G74 has increased the 275kV three-phase fault level by 8.1% and single-phase by 3.3%. The 110kV three-phase fault levels have increased by 13.9% and single-phase by 11.7%. As a result there are a number of fault levels at generation nodes now assessed to be higher and these are being managed e.g. by reconfiguring the system. As aged plant is replaced the need for these management regimes will reduce.

9. TRANSMISSION SYSTEM CAPABILITY - MATRIX STUDY

The matrix studies are designed to test the capability of the system to absorb major generation connections. Three separate load scenarios are examined with multiple loadflow studies. In each study contingency analysis is undertaken where the system is subjected to circuit outage and its performance examined. The three load scenarios involved supplying:

a) existing load
b) load in RoI
c) load in GB

Matrix and high level studies have been performed to construct a transmission system capability matrix (see Table 11); more detailed studies would be required by any party wishing to connect to the system. In particular the impact on the system voltage profile would be more rigorously assessed in detailed connection studies.

It is anticipated that by spring 2008, a new 275/110kV substation at Drumkee will be established. Nonetheless, by this time, the impact of load growth starts to stress the remaining transmission system during certain forced outage conditions. This is most obvious in potential overload conditions arising for double circuit outages in summer on the system close to Ballylumford. In winter when the load is higher, the system voltage is significantly depressed during some double circuit 275kV outages. Studies have shown that circa 100MVArs of reactive support is necessary to maintain the system voltage profile within limits. Locating a reactive compensator at Castlereagh would support the voltage in Belfast and alleviate other depressed system voltages under such circumstances.

Potential circuit overload conditions may be managed by re-configuration and special protection schemes. An example of this is operating the system so that the Lisburn load becomes radially supplied from Tandragee. This manages the loading on the Hannahstown interbus transformers. The Lisburn to Hannahstown circuits would however need to be closed during Hannahstown transformer maintenance, in case there is an unexpected outage on the other transformer. It is expected that the normal configuration of the 110kV circuits from Castlereagh to Ballylumford and from Ballylumford to Kells will be closed. A special protection scheme is being fitted which is designed to automatically open at Castlereagh and beyond Ballyvallagh when contingency overloads appear. The load on the circuits is related to the amount of system infeed from Islandmagee.

In earlier Statements an estimate of the cost of work was included for each element of the matrix. However in the last Statement it was noted that each transmission project is unique and the work needs to be estimated specifically. It may be misleading to use generic cost figures as guidance. It is therefore preferable to leave costing until specific projects are identified and instead the order of magnitude of costs gives an indication of the scale of the work. By indicating the work involved guidance is given as to the achievability of projects.

9.1 New Generation Supplying Existing Load

In this set of studies the effect of increasing generation by up to 400MW at each node without increasing the overall flow on the system is explored i.e. there is no increase in demand, but rather generation is reduced in other places. This helps to identify pure generation location issues. In these studies a 200MW transfer on the 275kV interconnector to the RoI has been applied. This is a different approach to that adopted in the main load flow analysis and takes into account an estimate of the market flows on the interconnector.

There are limits to what can be checked in this study and to avoid giving misleading information it is necessary to also refer to other work. The primary limitation of this study is that, in summer, there would not be sufficient NI load to allow full output from Ballylumford and Moyle, including a further 400MW generator at either location. Having separately explored the issues the result is similar to the section on transfer to RoI in that the single 275kV circuit Ballylumford-Kells (33km) and Ballylumford-Hannahstown (44km) 275kV double circuit overload.

To allow extra capacity the two circuits would need uprated, possibly by restringing using a higher rated conductor. However, it is prudent to allow for Static Var Compensation (SVC) as in this situation the system is close to the margin of voltage collapse. Voltage issues apart, no other generation locations give rise to system problems except for Coolkeeragh where the node is generation saturated. A further 275kV circuit between Coolkeeragh and Magherafelt would be required. Current estimates price this at approximately £0.8m per km – a total cost of approximately £45m.

9.2 Additional Generation Supplying Load in RoI

Recent history of traded energy flows indicates that there is normally a requirement to export approximately 200MW to the RoI. This is considered as a base position for the studies as it represents the most economic condition with the commercial and market arrangements in place at present. Therefore, in describing a new 400MW generator exporting to RoI there is the implication of a transfer of a total of 600MW but with no reactive power. The studies have taken no account of stability issues but it should be understood that a sudden loss of all North/South interconnection would need to be managed to avoid frequency violations. Two sets of issues emerge from the studies. These are:

(1) generation location, and
(2) increased system flow

9.2.1 Generation Location

The Islandmagee area is saturated as a generation source. The complete outage of a 275kV power line from Ballylumford or Moyle exposes other circuits to overload. The worst outage results in significant overloads on the Ballylumford to Kells 275kV circuit. This could be reconductored to a twin 700 sq mm circuit. The next worst outage results in overloads on the Ballylumford to Hannahstown 275kV circuit.

Coolkeeragh node is also saturated as a generation source. The worst outage is the Coolkeeragh-Magherafelt double circuit tower line that exposes the underlying 110kV system to heavy overloads and can result in voltage collapse. An appropriate reinforcement would be a further single 275kV circuit into Coolkeeragh.

In later years, generation located in the West (Magherafelt and Drumkee) would give rise to overloads on the underlying 110kV system for the outage of some 275kV circuits out of Tandragee and Magherafelt. However the planned introduction of Drumkee 275/110kV substation phase 2 works with an additional 110kV circuit between Drumkee and Dungannon and accompanying 110kV circuit reconfiguration work should resolve these issues (see Section 3.3). An example of nodes that are most likely to be suitable for connection of generation capacity are Kilroot, Kells, Magherafelt and Tandragee.

9.2.2 Increased System Flows

The worsened voltage problem resulting from increased flow to Louth depends on where additional generation is located. At Tandragee, the additional flow is minimised. If located at Castlereagh, the additional generator, de facto, supplies the Belfast load which reduces longer routed inflows. The studies show that generation located at Castlereagh is the least onerous case followed by generation at Tandragee and the worst is when additional generation is located at Islandmagee and Coolkeeragh. It has been necessary to add reactive power to solve the load flows, therefore the existing margin is too low and to manage this additional flow would require a

FACTS[3] device, which for the purposes of these studies is located at Castlereagh. It is estimated that the size of the device required would be in the range 60-120MVAr. NIE have allowed approximately £4m for this project.

9.3 Additional Generation Supplying Load in Scotland

Flows from GB through the Moyle interconnector have been relied upon to meet load requirements in NI, and to some degree in RoI. In this study, a further generator is introduced in NI and the flows are reversed on Moyle. It should be noted that whilst in previous years the input from Moyle was backed off. In these studies Moyle is considered with a full export to GB of up to 400MW. In summer this is effectively NI being self sufficient in capacity without support from GB and yet also able to supply 200MW to RoI. In winter there is heavier support from wind generation and this has reduced the flows to RoI.

There are two severe issues that arise from this set of studies. The first relates to locating generation at Coolkeeragh when a further 275kV Coolkeeragh to Magherafelt circuit would be required as previously mentioned. The other issue is the serious low voltage conditions following the double circuit outage Ballylumford to Moyle/Ballylumford to Hannahstown. This outage condition is worst when the additional generation is located at Ballylumford. It is also noted if an unexpected outage occurs with generation located in the west or north there will be a summer case overload on the 110kV circuits from Tandragee to Lisburn during the maintenance to a Hannahstown grid interbus transformer. It should be noted that there is a need to re-close these circuits during transformer maintenance.

9.4 Renewable and Embedded Generation

The evidence is that most embedded generation installed between now and 2013 is likely to be wind farms. Applications and enquires indicate that there is likely to be a heavy concentration of connections in the north and west of the province. It is anticipated that circa 600MW of plant will be wind sourced generation by 2013. Wind farms are becoming larger in size; while 5MW was the norm a few years ago connections of over 20MW are now common.

There are a number of issues that will limit the amount of wind power that can be connected. The significant issues are:

§ power variability and uncertainty

[3] Flexible AC Transmission System e.g. an Snychronous Voltage Compensator or STATCOM

- § technical uncertainty (voltage management, fault ride through, reserve etc), and
- § local system issues

Significant amounts of wind-sourced power are likely to create unmanageable variability and uncertainty. It is not clear that, with the reduced system inertia caused by certain types of wind farm power stations, the technical issues can be managed, so some level of constraint is likely to be imposed even before consideration is given to local system capacity issues.

To reduce technical uncertainty the NIE Grid Code Connection Conditions (Rev 5 15.03.2006) now specifically deal with wind generation and any other sizable plant that is intermittent in nature. SONI publish on their website the 'Wind quarterly report' to provide an update on wind generation issues and the NIE Grid Code.

9.5 Conclusion

Whilst incremental investments have been made on the system to facilitate development to the maximum, in the interests of supporting the competitive market, the day is not far removed when further more substantial investment will be required to support voltage and prevent over load problems. To get this far, in some cases it has been necessary to seek the support of generators to automatically reduce output or trip off machines during critical system conditions. It has also been necessary to replace equipment as fault levels rise. This should provide adequate fault level margin for the future.

The major issue facing the system relates to voltage stability, which is worsened for transfers to RoI and may be further worsened by a high penetration of wind-powered generation.

In over load terms the Islandmagee and Coolkeeragh areas are generation saturated. Backing off transfers from Scotland in favour of more generation located in the west (perhaps wind) can give rise to some overloads on the 110kV system.

In addition it remains a concern that high penetrations of wind energy could be destabilising. The NIE Grid Code developments offer some relief but further assessment is required to gauge the impact of reduced inertia and fault level on the system.

10. DEVELOPMENT OPPORTUNITIES

When NIE and SONI consider all major generation development projects, there will be a wide range of technical considerations to be taken into account. This will include factors such as system transient stability (the ability of the system to remain in synchronism during a system fault), system dynamic stability (the ability of the system to cope with the loss of a generating unit), and security of supply.

The impact of a project on fault level and the ability of equipment to withstand or interrupt fault current may be a significant factor. There is also a range of operating regime considerations, which would need to be assessed when looking at new developments. These would include load factor, maximum and minimum export/import and project lifetimes.

It is therefore impossible to be specific about where the best locations are for the development of generation or new major loads. However, from the studies, certain general points can be made as to where there is most spare capacity on the system.

It is simpler to deal separately with three general areas of development: new load, new generation and transmission system developments.

10.1 Opportunities for New Loads

For new loads of significant size, the primary system consideration will be the thermal capabilities of the existing system (local voltage issues may also have to be addressed). System power flows indicate that the 110kV system is heavily loaded in the west. New load would be more easily accommodated in the east, particularly close to the existing generation and the Moyle Interconnector, however an increase in load in the Belfast area may require additional voltage support.

Regular meetings take place with Invest NI to establish opportunities to connect large demand customers to the system. The load forecast is based on statistical analysis and results in demand trend data being used. However, increases or reductions due to large demand customers are taken into account in the forecast.

With the exception of Coolkeeragh, the 275kV system is based mainly on a 'ring' structure. This provides a strong 'backbone' to the system and allows for alternative feeding arrangements under outage conditions. Transmission Seven Year Capacity Statements prior to 2001 noted that the 275kV system had considerable redundancy. In 2001 it was noted that this is no longer true for the circuits leaving Islandmagee.

The 110kV system is generally more heavily loaded than the 275kV and connection of significant new load at 110kV is likely to require system upgrading. This is especially true in the west of the system and within and around Belfast. However, with the advent of the new power station at Coolkeeragh, significant load can now be accommodated there.

In summary, new load can be connected relatively easily near the major generation sources at Coolkeeragh, in the east, and adjacent to the Moyle Interconnector. In the west of the system, or in and around Belfast on the 110kV system, significant system upgrading may be required to accommodate new large loads.

10.2 Opportunities for New Generation

When considering new generation infeeds, the technical factors involved tend to be more complex than with new load developments. However, assuming that the dynamic effects of new generation have been taken into consideration, it is possible to identify general characteristics of the system that would indicate where new generation is most suited.

Adding additional generation may increase the fault level above rating depending on location. For any new generation proposal, it would be important to identify whether there is a requirement for switchgear upgrading as this can add significantly to project costs.

With respect to thermal considerations, significant new generation can be accepted at any of the 275kV nodes except those on Islandmagee and around Coolkeeragh.

The power flow diagrams give an indication of the predominant flows and ratings on the 110kV system. Using these, it is possible to identify whether new generation connected to the 110kV system will add to, or subtract from, the existing system loadings.

It may be important also to consider the impact of possible displacement of generation. Power station location has a significant impact on voltage support both in relation to the local system and to the overall post-fault voltage profile. Generation at Kilroot is particularly beneficial in maintaining post-fault system voltage profiles, since the station has direct connection to Kells, Castlereagh and Tandragee.

Unless wind power, and new or existing generation, in an area can be planned as alternatives, wind power is likely to use much of the local generation capacity of nodes.

In summary, the bias of the existing generation is to the east of the system, particularly when there is an import from the Moyle Interconnector. New generation is most easily accommodated near the 275kV ring system. There is a continuing role for generation in the north of the province and some scope in Belfast. There is also some scope for generation in the west. However, the new plant at Coolkeeragh saturates the present capacity at that node.

10.3 Possible Transmission Development Scenarios

As has been highlighted in the previous sections, there are defined areas of the transmission system where system loading is such that little spare transmission capacity exists. These are predominantly in the Islandmagee area. The system voltage profile is also of concern for faults in this area.

Even with a generating plant at Coolkeeragh there will be periods when generation is unavailable. The decision is whether to carry out system development or find other ways to manage the risk. A special protection scheme is in place to shed local load in rare worst-case outage conditions.

The power flow controlled circuit and capacitive support at Enniskillen maintains the voltages at Omagh and Enniskillen within limits, under peak loading conditions.

The power flows highlight a problem with loading on the Tandragee to Drumnakelly 110kV circuits. This problem has been addressed by a special protection scheme.

110kV re-supply to Creagh is heavily dependant upon the commissioning of the new Drumkee 275/110kV substation. Until that time, a failure in the Kells to Creagh 110kV circuit at periods of high load will result in load shedding in order to avoid unacceptable low voltage conditions. Limited load had been transferred to Creagh and operational measures will be taken to minimise the effects.

10.4 Conclusion

The existing 275kV transmission system is relatively robust with the exception that the large in-feed requirement at Islandmagee can give rise to heavy post-fault loading on the 275kV and parallel 110kV systems. The 110kV system towards the west and around Coolkeeragh remains heavily loaded. The introduction of the new Drumkee 275/110kV node at Dungannon will reduce the loading between Tandragee and Dungannon, improve resupply to Creagh. This will generally stabilise system voltage in the area. There is a generation saturation condition at the Coolkeeragh node.

Taking account of the planned developments detailed in Section 3.2, the existing NI transmission system, as indicated by the power flows, is compliant with planning standards. However, the loading and generation profiles on the system are constantly evolving and it is inevitable that system modifications will be required as changes take place.

LIST OF TABLES 1 – 12

Generating Plant Contracted Capacities – Table 1

Station		Fuel Used	Capacity (MW)	Contract Expiry Date
Kilroot				
	Unit 1[1]	HFO/Coal	260[1]	31-03-2024
	Unit 2[1]	HFO/Coal	260[1]	31-03-2024
	GT 1	Gasoil	29	31-03-2024
	GT 2	Gasoil	29	31-03-2024
Ballylumford				
	Unit 4[2]	Gas/HFO	180[2]	31-03-2012
	Unit 5[2]	Gas/HFO	0[2]	-
	Unit 6[2]	Gas/HFO	180[2]	31-10-2007
	GT 1	Gasoil	58	31-03-2020
	GT 2	Gasoil	58	31-03-2020
	GT A	Gas/Gasoil	250	31-03-2012
	GT B	Gas/Gasoil	250	31-03-2012
	GT D	Gas/Gasoil	106	31-03-2012
Coolkeeragh				
	GT 8	Gasoil	58	31-03-2018
Total			**1718**	

Note [1]: The Kilroot Units normally operate with coal firing, however their capacity can be increased from 220MW to 260MW by oil firing. The gas turbines are gas/oil fired with capacity reduced at non-peak times. These capacity reductions are ignored for generation security purposes.

Note [2]: During 2002/03, units 4, 5 and 6 at Ballylumford were replaced by new CCGT plant of similar total capacity. The NIE Power Procurement Business (PPB) subsequently swapped its contract for unit 1 with unit 4. Unit 4 now has a contracted capacity of 180MW. In addition, NIE PPB contracted with unit 6 (also reduced to 180MW) for on-supply to ESB. This arrangement ceased on 31 March 2006 but unit 6 remains under contract to NIE PPB in the short term, primarily to provide cover for major planned outages in 2006 and 2007.

Existing Generation (Contracted and IPP) – Table 1A

Station		Fuel Used	Capacity (MW)	NIE Contracted or IPP
Kilroot				
	Unit 1[1]	HFO/Coal	260[1]	NIE
	Unit 2[1]	HFO/Coal	260[1]	NIE
	GT 1	Gasoil	29	NIE
	GT 2	Gasoil	29	NIE
Ballylumford				
	Unit 4[2]	Gas/HFO	180[2]	NIE
	Unit 5[2]	Gas/HFO	0[2]	NIE
	Unit 6[2]	Gas/HFO	180[2]	NIE
	GT 1	Gasoil	58	NIE
	GT 2	Gasoil	58	NIE
	GT A	Gas/Gasoil	250	NIE
	GT B	Gas/Gasoil	250	NIE
	GT D	Gas/Gasoil	106	NIE
Coolkeeragh				
	C30	Gas/Gasoil	414	IPP
	GT 8	Gasoil	58	IPP
Moyle				
	DC Link		400[3]	
Total			**2532**	

[1] The Kilroot units normally operate with coal firing with a maximum capacity of 220MW, however their capacity can be increased to the fully contracted capacity of 260MW by switching to oil firing.

[2] Unit 5 can be used only as a replacement for units 4 or 6. The contract with unit 6 is extendable to 31-03-2008. Beyond that it is envisaged that unit 4 will stay contracted until 2012.

[3] Capacity can be increased to 450 MW under emergency conditions.

Non Fossil Fuel Obligations (NFFO) Capacity – Table 1B

Scheme Name	**Technology**	**Maximum Capacity kW**	**Contract Expiry Date**
NFFO1			
Rigged Hill	Wind	5000	31-03-2009
Corkey	Wind	5000	31-03-2009
Slieve Rushen	Wind	5000	31-03-2009
Elliott's Hill	Wind	5000	31-03-2009
Bessy Bell	Wind	5000	31-03-2009
Owenreagh	Wind	5000	31-03-2009
Harperstown	Hydro	250	31-03-2009
Benburb	Hydro	75	31-03-2009
Carrickness	Hydro	155	31-03-2009
Park Mills	Hydro	30	31-03-2009
Randalstown	Hydro	500	31-03-2009
Blackwater	Hydro	100	31-03-2009
Sion Mills	Hydro	780	31-03-2009
Oakland's WTW	Hydro	49	31-03-2009
Silent Valley	Hydro	435	31-03-2009
Total		**32 MW**	
NFFO2			
Lendrum's Bridge	Wind	5280	31-08-2013
Slievenahanaghan	Wind	1000	14-11-2012
Blackwater Museum	Biomass	204	30-06-2013
Brook Hall Estate	Biomass	100	31-10-2012
Benburb Small Hydro	Hydro	75	30-04-2012
Total		**39 MW**	

Additional Renewable Generation – Table 1C

Scheme Name	Technology	Maximum Capacity (MW)	Date Commissioned
Altahullion	Wind	26.0	April 2003
Lendrum's Bridge	Wind	7.9	October 2002
Snugborough	Wind	13.5	October 2003
Tappaghan	Wind	19.5	December 2004
Callagheen	Wind	16.9	January 2006
Total		83.8	

Approved Renewable Generation – Table 1D

Scheme Name	Technology	Maximum Capacity (MW)	Proposed Commissioning Date
Bin Mountain	Wind	9.0	Winter 0607
Slieve Rushen Ph 1	Wind	11.5	Winter 0607
Lough Hill	Wind	9.0	Summer 07
Owenreagh Ext	Wind	5.1	Summer 07
Altahullion Ext	Wind	11.7	Autumn 07
Garves	Wind	15.0	Winter 0708
Bessy Bell 2	Wind	11.7	Winter 0708
Wolf Bog	Wind	10.0	Summer 07
Slieve Rushen Ph 2	Wind	54.0	Winter 0708
Total		**138.5**	

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM **TABLE 2.1**

SEVEN YEAR STATEMENT 2006

Transformer Capacity and Loadings at Bulk Supply Points

Location	Total Transformer Capacity (MVA)	Substation Firm Capacity (MVA)	Forecast Loading (MVA)							NOTES
			06/07	07/08	08/09	09/10	10/11	11/12	12/13	
Antrim	90.0	45.0	47.21	48.08	48.94	49.81	50.67	51.54	52.40	1&3
Ballymena Rural	90.0	45.0	65.89	52.36	58.99	60.98	49.17	50.85	52.53	1&2&3&7
Ballymena Town	120.0	72.0	48.26	49.22	50.19	51.15	52.11	53.08	54.04	
Ballynahinch	180.0	71.4	63.03	65.02	67.02	69.02	71.02	73.01	75.01	
Banbridge	120.0	55.3	42.47	50.14	51.21	52.27	53.33	54.39	55.46	3
Creagh	120.0	78.0	6.70	22.37	22.61	22.85	36.90	37.45	38.01	2&6
Coleraine	120.0	78.0	50.80	52.52	54.24	55.96	57.68	59.40	61.13	6
Coolkeeragh	180.0	116.6	65.15	64.81	64.48	64.14	63.81	63.48	63.14	
Drumnakelly	180.0	111.2	109.17	106.35	98.82	102.42	106.02	109.62	113.22	2&7
Dungannon	180.0	117.0	102.38	105.64	108.89	112.14	115.39	118.64	121.90	3&7
Eden	90.0	37.4	33.31	33.86	34.40	34.95	35.49	36.04	36.58	1
Enniskillen	150.0	117.0	80.24	86.88	89.51	92.14	94.78	97.41	100.05	1&6
Finaghy	90.0	58.5	40.63	41.49	42.34	43.19	44.05	44.90	45.76	
Larne	90.0	55.3	47.83	48.96	45.35	46.37	47.39	48.42	49.44	1
Limavady	90.0	40.3	34.27	35.69	37.11	38.53	39.95	41.37	42.78	3
Lisaghmore	90.0	58.5	54.67	55.94	57.21	58.48	59.74	61.01	62.28	2&6
Lisburn(N+S)	180.0	93.0	68.87	78.46	81.04	83.63	86.21	88.80	91.38	
Loguestown	90.0	55.3	41.26	41.85	42.44	43.04	43.63	44.22	44.81	
Newry	180.0	74.0	79.18	81.10	83.01	84.92	86.83	88.74	90.65	3
Newtownards	120.0	78.0	46.26	46.68	47.11	47.53	47.95	48.38	48.80	6
Omagh	120.0	78.0	51.84	52.98	54.12	55.26	56.40	57.54	58.68	6
Rathgael	180.0	85.0	62.48	65.84	66.24	66.65	67.06	67.47	67.88	1&7
Rosebank	180.0	111.2	44.87	36.46	36.32	36.19	54.56	54.85	55.15	2
Strabane	90.0	38.0	35.16	35.53	35.90	36.27	36.64	37.01	37.38	
Waringstown	90.0	58.5	55.08	55.85	67.93	68.90	69.86	70.82	71.79	2&3
West Belfast Central	150.0 180.0	267.0	119.38	125.42	128.47	130.48	132.52	134.57	136.46	5
Carnmoney	120.0	60.0	41.59	42.43	43.27	43.83	44.42	45.01	45.55	1&4
Glengormley	60.0	30.8	13.01	12.99	12.97	13.23	13.49	13.76	14.01	4
Cregagh	150.0	78.9	71.77	74.28	69.82	72.26	74.83	77.50	76.30	
Knock	120.0	59.7	60.84	66.70	67.25	67.77	57.31	57.66	57.92	1&2&3
Donegall North	150.0	73.0	56.33	56.14	55.95	55.73	55.54	55.34	55.07	1
Donegall South	120.0	78.0	53.20	53.31	53.42	53.51	53.62	53.73	53.77	1

NOTES
1 Transformer exceeds 40 years, condition assessment may be required to evaluate rating
2 Load to be transferred
3 It is planned to manage capacity issues within RP4
4 Present arrangement has Carnmoney supplying circa 15MW at Glengormley Rear Busbar
5 Both sources are interconnected via 33kV cables
6 Firm capacity based on transformer short term overload capacity may be limited by other network components
7 Load shedding scheme in place

Substation exceeded Firm Capacity - [grey shading]

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM TABLE 2.2

SEVEN YEAR STATEMENT 2006

Substation Available Capacity

Location	Total Transformer Capacity (MVA)	Substation Firm Capacity(MVA)	Forecasted available Substation Capacity Loading (MVA)							NOTES
			06/07	07/08	08/09	09/10	10/11	11/12	12/13	
Antrim	90.0	45.0	-2.21	-3.08	-3.94	-4.81	-5.67	-6.54	-7.40	1&3
Ballymena Rural	90.0	45.0	-20.89	-7.36	-13.99	-15.98	-4.17	-5.85	-7.53	1&2&3&7
Ballymena Town	120.0	72.0	23.74	22.78	21.81	20.85	19.89	18.92	17.96	
Ballynahinch	180.0	71.4	8.37	6.38	4.38	2.38	0.38	-1.61	-3.61	
Banbridge	120.0	55.3	12.83	5.16	4.09	3.03	1.97	0.91	-0.16	3
Creagh	120.0	78.0	71.30	55.63	55.39	55.15	41.10	40.55	39.99	2&6
Coleraine	120.0	78.0	27.20	25.48	23.76	22.04	20.32	18.60	16.87	6
Coolkeeragh	180.0	116.6	51.43	51.76	52.09	52.43	52.76	53.10	53.43	
Drumnakelly	180.0	111.2	2.06	4.88	12.41	8.81	5.21	1.61	-1.99	2&7
Dungannon	180.0	117.0	14.62	11.36	8.11	4.86	1.61	-1.64	-4.90	3
Eden	90.0	37.4	4.12	3.58	3.03	2.48	1.94	1.39	0.85	1
Enniskillen	150.0	117.0	36.76	30.12	27.49	24.86	22.22	19.59	16.95	1&6
Finaghy	90.0	58.5	17.87	17.01	16.16	15.31	14.45	13.60	12.74	
Larne	90.0	55.3	7.47	6.34	9.95	8.93	7.91	6.88	5.86	1
Limavady	90.0	40.3	6.03	4.61	3.19	1.77	0.35	-1.07	-2.48	3
Lisaghmore	90.0	58.5	3.83	2.56	1.29	0.02	-1.24	-2.51	-3.78	2&6
Lisburn(N+S)	180.0	93.0	24.13	14.55	11.96	9.37	6.79	4.20	1.62	
Loguestown	90.0	55.3	14.05	13.46	12.87	12.27	11.68	11.09	10.50	
Newry	180.0	74.0	-5.18	-7.10	-9.01	-10.92	-12.83	-14.74	-16.65	3
Newtownards	120.0	78.0	31.74	31.32	30.89	30.47	30.05	29.62	29.20	6
Omagh	120.0	78.0	26.16	25.02	23.88	22.74	21.60	20.46	19.32	6
Rathgael	180.0	85.0	22.52	19.16	18.76	18.35	17.94	17.53	17.12	1&7
Rosebank	180.0	111.2	66.36	74.77	74.91	75.04	56.67	56.38	56.08	2
Strabane	90.0	38.0	2.84	2.47	2.10	1.73	1.36	0.99	0.62	
Waringstown	90.0	58.5	3.42	2.66	-9.43	-10.40	-11.36	-12.32	-13.29	2&3
West Belfast Central	150.0 180.0	267.0	147.62	141.58	138.53	136.52	134.48	132.43	130.54	5
Carnmoney	120.0	60.0	18.41	17.57	16.73	16.17	15.58	14.99	14.45	1&4
Glengormley	60.0	30.8	17.79	17.81	17.83	17.57	17.31	17.04	16.79	4
Cregagh	150.0	78.9	7.08	4.57	9.03	6.59	4.02	1.35	2.55	
Knock	120.0	59.7	-1.17	-7.03	-7.58	-8.10	2.36	2.01	1.75	1&2&3
Donegall North	150.0	73.0	16.67	16.86	17.05	17.27	17.46	17.66	17.93	1
Donegall South	120.0	78.0	24.80	24.69	24.58	24.49	24.38	24.27	24.23	1

NOTES

1 Transformer exceeds 40 years, condition assessment may be required to evaluate rating
2 Load to be transferred
3 It is planned to manage capacity issues within RP4
4 Present arrangement has Carnmoney supplying circa 15MW at Glengormley Rear Busbar
5 Both sources are interconnected via 33kV cables
6 Firm capacity based on transformer short term overload capacity may be limited by other network components
7 Load shedding scheme in place

Zero capacity available - (shaded)

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM DATA LISTING					
BUS DATA - WINTER 2006/07			Table 3		
BUS NUMBER	NODE NAME	Name	VOLTAGE (kV)	PLOAD (MW)	QLOAD (Mvar)
1981	CORRACL	ESB PLANT	110		
3522	LOUTH		220		
3581	LETRKENY		110		
35231	LOUTH5 A		275		
35232	LOUTH5 B		275		
60101	RIGGED	WINDFARMS	33		
60102	CORK&SLI		33		
60103	SLIE&SNU		33		
60104	ELLIOTSH		33		
60105	BESS&LEN		33		
60106	OWENREAG		33		
60107	ALTAH		33		
70011	ANTR1A	ANTRIM	110		
70012	ANTR1B		110		
70030	ANTR3-		33	44.85	14.74
70504	BAFDG4	BALLYLUMFORD	15		
70505	BAFDG5		15	18.64	6.21
70506	BAFDG6		15	18.64	6.21
70507	BAFDG7		11		
70508	BAFDG8		11		
70510	BAFD1-		110	9.32	3.11
70513	BAFD_GA		15	4.66	1.55
70514	BAFD_GB		15	4.66	1.55
70515	BAFD_GC		18	4.66	1.55
70516	BAFD_GD		15	4.66	1.55
70520	BAFD2-		275		
70561	BAFD6P		22		
70562	BAFD6Q		22		
70571	BAFD7P		22		
70572	BAFD7Q		22		
70580	BAFD8-		3.3		
71011	BAME1A	BALLYMENA	110		
71012	BAME1B		110		
71031	BAME3R		33	62.6	20.58
71032	BAME3T		33	45.85	15.07
71511	BANB1A	BANBRIDGE	110		
71512	BANB1B		110		
71530	BANB3-		33	40.34	13.26
72010	BAVA1-	BALLYVALLAGH	110		
72511	BNCH1A	BALLYNAHINCH	110		
72512	BNCH1B		110		
72530	BNCH3-		33	59.88	19.68
74011	CARN1A	CARNMONEY	110		
74012	CARN1B		110		
74030	CARN3-		33	26.34	8.66

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM DATA LISTING					
BUS DATA - WINTER 2006/07			Table 3		
BUS NUMBER	**NODE NAME**	**Name**	**VOLTAGE (kV)**	**PLOAD (MW)**	**QLOAD (Mvar)**
74511	CAST1A	CASTLEREAGH	110		
74512	CAST1B		110		
74520	CAST2-		275		
74561	CAST6P		22		
74562	CAST6Q		22		
74563	CAST6R		22		
74571	CAST7P		22		
74572	CAST7Q		22		
74573	CAST7R		22		
74711	CENT1A	BELFAST CENTRAL	110		
74712	CENT1B		110		
74731	CENT3A		33	30.29	9.96
74732	CENT3B		33	30.29	9.96
75010	COLE1-	COLERAINE	110		
75030	COLE3-		33	48.26	15.86
73521	CACO2A	COOLKEERAGH	275		
73522	CACO2B		275		
75508	COOLG8-		11		
75510	COOL1-		110		
75514	COOL1C		110		
75515	COOLST-		11.8	4.66	1.55
75516	COOLGT-		16	7.77	2.59
75520	COOL2-		275		
75530	COOL3-		33	61.89	20.34
75561	COOL6P		22		
75562	COOL6Q		22		
75571	COOL7P		22		
75572	COOL7Q		22		
75810	CREA1-	CREAGH	110		
75830	CREA3-		33	6.36	2.09
75911	CREC1A		110		
75912	CREC1B		110		
76011	CREG1A	CREGAGH	110		
76012	CREG1B		110		
76031	CREG3A		33	26.27	8.64
76032	CREG3B		33	12.05	3.96
76511	DONE1C	DONEGAL	110		
76512	DONE1B		110		
76513	DONE1D		110		
76514	DONE1A		110		
76531	DONE3AS		33	50.54	16.61
76532	DONE3N		33	44.8	14.73
76533	DONE3BS		33	8.71	2.86
77010	DRUM1-	DRUMNAKELLY	110		
77030	DRUM3-		33	103.71	34.09

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM DATA LISTING					
		BUS DATA - WINTER 2006/07		Table 3	
BUS NUMBER	NODE NAME	Name	VOLTAGE (kV)	PLOAD (MW)	QLOAD (Mvar)
77510	DUNG1-	DUNGANNON	110		
77530	DUNG3-		33	97.26	31.97
78030	DUNM3-		33	21.68	7.13
78511	EDEN1A	EDEN	110		
78512	EDEN1B		110		
78530	EDEN3-		33	31.64	10.4
79010	ENNK1_	ENNISKILLEN	110		
79015	ENNKPFA		110		
79016	ENNKPFB		110		
79030	ENNK3-		33	76.23	25.06
80011	FINY1A	FINAGHY	110		
80012	FINY1B		110		
80030	FINY3-		33	38.6	12.69
80511	GLEN1A	GLENGORMLEY	110		
80512	GLEN1B		110		
80531	GLEN3A		33	12.36	4.06
80532	GLEN3B		33	13.17	4.33
81010	HANA1A	HANNAHSTOWN	110		
81020	HANA2A		275		
81061	HANA6P		22		
81062	HANA6Q		22		
81071	HANA7P		22		
81072	HANA7Q		22		
81510	KELS1-	KELLS	110		
81520	KELS2-		275		
81561	KELS6P		22		
81562	KELS6Q		22		
81571	KELS7P		22		
81572	KELS7Q		22		
82001	KILRG1-	KILROOT	17	18.64	6.21
82002	KILRG2-		17	18.64	6.21
82020	KILR2-		275		
82511	KNCK1A	KNOCK	110		
82512	KNCK1B		110		
82531	KNCK3A		33	22.88	7.52
82532	KNCK3B		33	22.88	7.52
83011	LARN1A	LARNE	110		
83012	LARN1B		110		
83030	LARN3-		33	45.44	14.94
83510	LIMA1-	LIMAVADY	110		
83530	LIMA3-		33	32.56	10.7
84011	LISB1A	LISBURN	110		
84012	LISB1B		110		
84030	LISB3-		33	65.43	21.5

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM DATA LISTING					
		BUS DATA - WINTER 2006/07		Table 3	
BUS NUMBER	NODE NAME	Name	VOLTAGE (kV)	PLOAD (MW)	QLOAD (Mvar)
84411	LSMR1A	LISAGHMORE	110		
84412	LSMR1B		110		
84430	LSMR3-		33	51.94	17.07
84511	LOGE1A	LOGUESTOWN	110		
84512	LOGE1B		110		
84530	LOGE3-		33	39.2	12.88
85020	MAGF2-	MAGHERAFELT	275		
86031	MOUN3A	MOUNTPOTTINGER	33	20.95	6.89
86032	MOUN3B		33	20.95	6.89
86220	MOYL2-	MOYLE	275		
86221	SCOT2-		275		
86311	NARD1A	NEWTOWNARDS	110		
86312	NARD1B		110		
86330	NARD3-		33	43.94	14.44
86511	NEWY1A	NEWRY	110		
86512	NEWY1B		110		
86530	NEWY3-		33	75.22	24.73
87011	NORF1A	NORFIL	110		
87012	NORF1B		110		
87030	NORF3-		33	0	0
87510	OMAH1-	OMAGH	110		
87530	OMAH3-		33	49.25	16.19
88011	RATH1A	RATHGAEL	110		
88012	RATH1B		110		
88030	RATH3-		33	59.36	19.51
88511	ROSE1A	ROSEBANK	110		
88512	ROSE1B		110		
88530	ROSE3-		33	42.63	14.01
89030	SKEG3-	SKEGONEILL	33	31.15	10.24
89510	STRA1-	STRABANE	110		
89515	STRPFCA		110		
89516	STRPFCB		110		
89530	STRA3-		33	33.4	10.98

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM DATA LISTING BUS DATA - WINTER 2006/07 Table 3					
BUS NUMBER	NODE NAME	Name	VOLTAGE (kV)	PLOAD (MW)	QLOAD (Mvar)
90011	TAND1A	TANDRAGEE	110		
90012	TAND1B		110		
90020	TAND2-		275		
90061	TAND6P		22		
90062	TAND6Q		22		
90063	TAND6R		22		
90071	TAND7P		22		
90072	TAND7Q		22		
90073	TAND7R		22		
90511	WARN1A	WARINGSTOWN	110		
90512	WARN1B		110		
90530	WARN3-		33	52.32	17.2
91011	WEST1A	PSW	110		
91012	WEST1B		110		
91031	WEST3A		33	0	0
91032	WEST3B		33	0	0

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM DATA LISTING BRANCH DATA - WINTER 2006/07 Table 4								
From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE			RATING IN MVA		
			RESISTANCE	REACTANCE	SUSCEPTANCE	WINTER	AUTUMN	SUMMER
1981 [CORRACL 110.00]	79016 [ENNKPFB 110.00]	1	0.04720	0.10680	0.01020	124	115	106
3581 [LETRKENY 110.00]	89516 [STRPFCB 110.00]	1	0.03498	0.07926	0.00759	126	115	106
35231 [LOUTH5 A 275.00]	35232 [LOUTH5 B 275.00]	1	0.00000	0.00010	0.00000	1000	1000	1000
35231 [LOUTH5 A 275.00]	90020 [TAND2- 275.00]	1	0.00240	0.02110	0.12690	881	820	710
35232 [LOUTH5 B 275.00]	90020 [TAND2- 275.00]	2	0.00240	0.02110	0.12690	881	820	710
60101 [RIGGED 33.000]	75030 [COLE3- 33.000]	1	0.00000	0.00010	0.00000	0	0	0
60102 [CORK&SLI 33.000]	71031 [BAME3R 33.000]	1	0.00000	0.00010	0.00000	0	0	0
60103 [SLIE&SNU 33.000]	79030 [ENNK3- 33.000]	1	0.00000	0.00010	0.00000	0	0	0
60104 [ELLIOTSH 33.000]	83030 [LARN3- 33.000]	1	0.00000	0.00010	0.00000	0	0	0
60105 [BESS&LEN 33.000]	87530 [OMAH3- 33.000]	1	0.00000	0.00010	0.00000	0	0	0
60106 [OWENREAG 33.000]	89530 [STRA3- 33.000]	1	0.00000	0.00010	0.00000	0	0	0
60107 [ALTAH 33.000]	83530 [LIMA3- 33.000]	1	0.00000	0.00010	0.00000	0	0	0
70011 [ANTR1A 110.00]	81510 [KELS1- 110.00]	1	0.01280	0.02940	0.00310	103	95	82
70011 [ANTR1A 110.00]	87011 [NORF1A 110.00]	1	0.00080	0.00080	0.00770	84	76	76
70012 [ANTR1B 110.00]	81510 [KELS1- 110.00]	1	0.01280	0.02940	0.00310	103	95	82
70012 [ANTR1B 110.00]	87012 [NORF1B 110.00]	1	0.00080	0.00080	0.00770	84	76	76
70510 [BAFD1- 110.00]	72010 [BAVA1- 110.00]	1	0.02520	0.05760	0.00610	103	95	82
70510 [BAFD1- 110.00]	72010 [BAVA1- 110.00]	2	0.02520	0.05760	0.00610	103	95	82
70510 [BAFD1- 110.00]	78511 [EDEN1A 110.00]	1	0.02280	0.05350	0.00480	86	80	69
70510 [BAFD1- 110.00]	78512 [EDEN1B 110.00]	1	0.02280	0.05270	0.00480	87	81	70
70520 [BAFD2- 275.00]	81020 [HANA2A 275.00]	2	0.00230	0.01960	0.12700	881	820	710
70520 [BAFD2- 275.00]	81520 [KELS2- 275.00]	1	0.00170	0.01500	0.09040	881	820	710
70520 [BAFD2- 275.00]	85020 [MAGF2- 275.00]	1	0.00320	0.02860	0.17200	881	820	710
70520 [BAFD2- 275.00]	86220 [MOYL2- 275.00]	1	0.00010	0.00130	0.00810	881	820	710
70561 [BAFD6P 22.000]	70571 [BAFD7P 22.000]	1	0.00000	0.00010	0.00000	0	0	0
70562 [BAFD6Q 22.000]	70572 [BAFD7Q 22.000]	1	0.00000	0.00010	0.00000	0	0	0
71011 [BAME1A 110.00]	81510 [KELS1- 110.00]	1	0.01540	0.03680	0.00355	124	119	109
71012 [BAME1B 110.00]	81510 [KELS1- 110.00]	1	0.01540	0.03680	0.00355	124	119	109
71511 [BANB1A 110.00]	90011 [TAND1A 110.00]	1	0.02360	0.05460	0.00555	103	95	82
71512 [BANB1B 110.00]	90011 [TAND1A 110.00]	1	0.02360	0.05460	0.00555	103	95	82
72010 [BAVA1- 110.00]	81510 [KELS1- 110.00]	1	0.03040	0.07220	0.00700	124	119	109
72010 [BAVA1- 110.00]	81510 [KELS1- 110.00]	2	0.03040	0.07220	0.00700	103	95	82
72010 [BAVA1- 110.00]	83011 [LARN1A 110.00]	1	0.00720	0.02340	0.00250	113	96	80
72010 [BAVA1- 110.00]	83012 [LARN1B 110.00]	1	0.00720	0.02340	0.00250	113	96	80
72511 [BNCH1A 110.00]	74512 [CAST1B 110.00]	1	0.03080	0.07060	0.00740	103	95	82
72512 [BNCH1B 110.00]	74512 [CAST1B 110.00]	1	0.03080	0.07060	0.00740	103	95	82
73521 [CACO2A 275.00]	75520 [COOL2- 275.00]	1	0.00010	0.00010	0.02280	837	761	761
73521 [CACO2A 275.00]	85020 [MAGF2- 275.00]	1	0.00670	0.02400	0.14950	513	477	412
73522 [CACO2B 275.00]	75520 [COOL2- 275.00]	1	0.00010	0.00010	0.01930	837	761	761
73522 [CACO2B 275.00]	85020 [MAGF2- 275.00]	1	0.00670	0.02400	0.14950	513	477	412
74011 [CARN1A 110.00]	74511 [CAST1A 110.00]	1	0.03710	0.08690	0.00780	87	80	69
74011 [CARN1A 110.00]	78511 [EDEN1A 110.00]	1	0.01870	0.04390	0.00400	86	80	69
74012 [CARN1B 110.00]	74511 [CAST1A 110.00]	1	0.03710	0.08570	0.00780	87	80	69
74012 [CARN1B 110.00]	78512 [EDEN1B 110.00]	1	0.01870	0.04330	0.00400	87	81	70
74030 [CARN3- 33.000]	80532 [GLEN3B 33.000]	1	0.03510	0.02070	0.00330	17.1	17.1	17.1
74030 [CARN3- 33.000]	80532 [GLEN3B 33.000]	2	0.03510	0.02070	0.00330	17.1	17.1	17.1
74511 [CAST1A 110.00]	74512 [CAST1B 110.00]	1	0.00000	0.00010	0.00000	1000	1000	1000
74511 [CAST1A 110.00]	74512 [CAST1B 110.00]	2	0.00000	0.00010	0.00000	1000	1000	1000
74511 [CAST1A 110.00]	88511 [ROSE1A 110.00]	1	0.00100	0.00180	0.02545	128	117	117
74511 [CAST1A 110.00]	88512 [ROSE1B 110.00]	1	0.00100	0.00180	0.02545	128	117	117

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM DATA LISTING

BRANCH DATA - WINTER 2006/07 Table 4

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE			RATING IN MVA		
			RESISTANCE	REACTANCE	SUSCEPTANCE	WINTER	AUTUMN	SUMMER
74512 [CAST1B 110.00]	76011 [CREG1A 110.00]	1	0.00120	0.00360	0.06080	145	132	132
74512 [CAST1B 110.00]	76012 [CREG1B 110.00]	1	0.00120	0.00360	0.06080	145	132	132
74512 [CAST1B 110.00]	82511 [KNCK1A 110.00]	1	0.00520	0.00440	0.04370	73	66	66
74512 [CAST1B 110.00]	82512 [KNCK1B 110.00]	1	0.00520	0.00440	0.04370	73	66	66
74512 [CAST1B 110.00]	86311 [NARD1A 110.00]	1	0.02530	0.05880	0.04640	103	95	82
74512 [CAST1B 110.00]	86312 [NARD1B 110.00]	1	0.02530	0.05880	0.04640	103	95	82
74512 [CAST1B 110.00]	88011 [RATH1A 110.00]	1	0.02740	0.06300	0.00660	103	95	82
74512 [CAST1B 110.00]	88012 [RATH1B 110.00]	1	0.02740	0.06300	0.00660	103	95	82
74520 [CAST2- 275.00]	81020 [HANA2A 275.00]	1	0.00090	0.00780	0.05060	881	820	710
74520 [CAST2- 275.00]	81020 [HANA2A 275.00]	2	0.00090	0.00790	0.05060	881	820	710
74520 [CAST2- 275.00]	82020 [KILR2- 275.00]	1	0.00340	0.02940	0.17810	881	820	710
74520 [CAST2- 275.00]	90020 [TAND2- 275.00]	1	0.00230	0.01910	0.12350	881	820	710
74561 [CAST6P 22.000]	74571 [CAST7P 22.000]	1	0.00000	0.00010	0.00000	0	0	0
74562 [CAST6Q 22.000]	74572 [CAST7Q 22.000]	1	0.00000	0.00010	0.00000	0	0	0
74563 [CAST6R 22.000]	74573 [CAST7R 22.000]	1	0.00000	0.00010	0.00000	0	0	0
74711 [CENT1A 110.00]	76011 [CREG1A 110.00]	1	0.00111	0.00462	0.02222	145	144	144
74712 [CENT1B 110.00]	76012 [CREG1B 110.00]	1	0.00111	0.00462	0.02222	145	144	144
74731 [CENT3A 33.000]	74732 [CENT3B 33.000]	1	0.00010	0.00010	0.00000	1000	1000	1000
74731 [CENT3A 33.000]	86031 [MOUN3A 33.000]	1	0.01290	0.26890	0.00300	33	30	30
74731 [CENT3A 33.000]	91031 [WEST3A 33.000]	1	0.01300	0.26699	0.00400	33	30	30
74731 [CENT3A 33.000]	91031 [WEST3A 33.000]	2	0.01245	0.26627	0.00400	33	30	30
74732 [CENT3B 33.000]	86032 [MOUN3B 33.000]	1	0.01290	0.26890	0.00300	33	30	30
74732 [CENT3B 33.000]	91032 [WEST3B 33.000]	1	0.01925	0.26296	0.00400	33	30	30
74732 [CENT3B 33.000]	91032 [WEST3B 33.000]	2	0.01171	0.26530	0.00400	33	30	30
75010 [COLE1- 110.00]	75510 [COOL1- 110.00]	1	0.06700	0.15390	0.01610	103	95	82
75010 [COLE1- 110.00]	81510 [KELS1- 110.00]	1	0.08560	0.20200	0.01970	103	95	82
75010 [COLE1- 110.00]	83510 [LIMA1- 110.00]	1	0.02700	0.06410	0.00610	103	95	82
75010 [COLE1- 110.00]	84511 [LOGE1A 110.00]	1	0.01160	0.02700	0.00280	103	95	82
75010 [COLE1- 110.00]	84512 [LOGE1B 110.00]	1	0.01160	0.02700	0.00280	103	95	82
75510 [COOL1- 110.00]	75514 [COOL1C 110.00]	1	0.00000	0.00010	0.00000	0	0	0
75510 [COOL1- 110.00]	83510 [LIMA1- 110.00]	1	0.04280	0.10110	0.00980	103	95	82
75510 [COOL1- 110.00]	84411 [LSMR1A 110.00]	1	0.01304	0.02994	0.00315	103	95	82
75510 [COOL1- 110.00]	84412 [LSMR1B 110.00]	1	0.01304	0.02994	0.00315	103	95	82
75510 [COOL1- 110.00]	89510 [STRA1- 110.00]	1	0.01800	0.05170	0.01690	166	158	144
75510 [COOL1- 110.00]	89510 [STRA1- 110.00]	2	0.01820	0.07860	0.00840	166	158	144
75561 [COOL6P 22.000]	75571 [COOL7P 22.000]	1	0.00000	0.00010	0.00000	0	0	0
75562 [COOL6Q 22.000]	75572 [COOL7Q 22.000]	1	0.00000	0.00010	0.00000	0	0	0
75810 [CREA1- 110.00]	75911 [CREC1A 110.00]	1	0.00023	0.00088	0.00614	144	144	144
75810 [CREA1- 110.00]	75912 [CREC1B 110.00]	1	0.00023	0.00088	0.00614	144	144	144
75911 [CREC1A 110.00]	81510 [KELS1- 110.00]	1	0.02923	0.07642	0.01283	103	95	82
75912 [CREC1B 110.00]	77510 [DUNG1- 110.00]	1	0.04727	0.12489	0.01733	103	95	82
76031 [CREG3A 33.000]	76032 [CREG3B 33.000]	1	0.00000	0.00010	0.00000	1000	1000	1000
76031 [CREG3A 33.000]	86031 [MOUN3A 33.000]	1	0.00670	0.01190	0.00620	50	46	46
76031 [CREG3A 33.000]	86032 [MOUN3B 33.000]	1	0.00670	0.01190	0.00620	50	46	46
76032 [CREG3B 33.000]	82531 [KNCK3A 33.000]	1	0.02000	0.03000	0.00400	33	30	30
76032 [CREG3B 33.000]	82532 [KNCK3B 33.000]	1	0.02000	0.03000	0.00400	33	30	30

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM DATA LISTING

BRANCH DATA - WINTER 2006/07 Table 4

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE			RATING IN MVA		
			RESISTANCE	REACTANCE	SUSCEPTANCE	WINTER	AUTUMN	SUMMER
76511 [DONE1C 110.00]	81010 [HANA1A 110.00]	1	0.00170	0.00470	0.14550	158	144	144
76511 [DONE1C 110.00]	91011 [WEST1A 110.00]	1	0.00570	0.00550	0.06320	82	75	75
76512 [DONE1B 110.00]	81010 [HANA1A 110.00]	1	0.00170	0.00470	0.14550	158	144	144
76512 [DONE1B 110.00]	91012 [WEST1B 110.00]	1	0.00560	0.00530	0.06090	82	75	75
76513 [DONE1D 110.00]	80012 [FINY1B 110.00]	1	0.00540	0.01240	0.00120	87	81	70
76514 [DONE1A 110.00]	80011 [FINY1A 110.00]	1	0.00540	0.01240	0.00120	86	80	69
76531 [DONE3AS 33.000]	76533 [DONE3BS 33.000]	1	0.00000	0.00010	0.00000	0	0	0
76532 [DONE3N 33.000]	76533 [DONE3BS 33.000]	1	0.00000	0.00100	0.00000	34.2	34.2	34.2
76532 [DONE3N 33.000]	76533 [DONE3BS 33.000]	2	0.00000	0.00100	0.00000	34.2	34.2	34.2
77010 [DRUM1- 110.00]	77510 [DUNG1- 110.00]	1	0.03700	0.08600	0.00880	103	95	82
77010 [DRUM1- 110.00]	77510 [DUNG1- 110.00]	2	0.04080	0.09450	0.00970	103	95	82
77010 [DRUM1- 110.00]	90011 [TAND1A 110.00]	1	0.00460	0.01480	0.00160	113	96	80
77010 [DRUM1- 110.00]	90011 [TAND1A 110.00]	2	0.00460	0.01480	0.00160	113	96	80
77010 [DRUM1- 110.00]	90011 [TAND1A 110.00]	3	0.00550	0.01520	0.00140	119	106	96
77510 [DUNG1- 110.00]	87510 [OMAH1- 110.00]	1	0.05218	0.12421	0.01186	124	119	109
77510 [DUNG1- 110.00]	87510 [OMAH1- 110.00]	2	0.05832	0.13881	0.01325	124	119	109
78030 [DUNM3- 33.000]	89030 [SKEG3- 33.000]	1	0.01780	0.01200	0.00400	30.8	28	28
78030 [DUNM3- 33.000]	89030 [SKEG3- 33.000]	2	0.01350	0.01270	0.00550	34.4	31.3	31.3
78030 [DUNM3- 33.000]	91031 [WEST3A 33.000]	1	0.02120	0.27190	0.00300	33	33	30
78030 [DUNM3- 33.000]	91032 [WEST3B 33.000]	1	0.02030	0.27090	0.00300	33	33	30
79010 [ENNK1_ 110.00]	87510 [OMAH1- 110.00]	1	0.04880	0.11200	0.01180	103	95	82
79010 [ENNK1_ 110.00]	87510 [OMAH1- 110.00]	2	0.04880	0.11200	0.01180	103	95	82
80011 [FINY1A 110.00]	81010 [HANA1A 110.00]	1	0.00100	0.00300	0.05067	144	144	144
80012 [FINY1B 110.00]	81010 [HANA1A 110.00]	1	0.00100	0.00300	0.05067	144	144	144
80511 [GLEN1A 110.00]	81510 [KELS1- 110.00]	1	0.03040	0.06780	0.03040	90	82	82
80512 [GLEN1B 110.00]	81510 [KELS1- 110.00]	1	0.03040	0.06780	0.03040	90	82	82
80531 [GLEN3A 33.000]	80532 [GLEN3B 33.000]	1	0.00000	0.00010	0.00000	1000	1000	1000
81010 [HANA1A 110.00]	84011 [LISB1A 110.00]	1	0.01589	0.03781	0.00368	144	144	144
81010 [HANA1A 110.00]	84012 [LISB1B 110.00]	1	0.01291	0.03987	0.00358	144	144	144
81020 [HANA2A 275.00]	86220 [MOYL2- 275.00]	1	0.00220	0.01880	0.12210	881	820	710
81061 [HANA6P 22.000]	81071 [HANA7P 22.000]	1	0.00000	0.00010	0.00000	0	0	0
81062 [HANA6Q 22.000]	81072 [HANA7Q 22.000]	1	0.00000	0.00010	0.00000	0	0	0
81520 [KELS2- 275.00]	82020 [KILR2- 275.00]	1	0.00150	0.01280	0.07690	881	820	710
81520 [KELS2- 275.00]	82020 [KILR2- 275.00]	2	0.00150	0.01280	0.07690	881	820	710
81520 [KELS2- 275.00]	85020 [MAGF2- 275.00]	1	0.00150	0.01350	0.08140	881	820	710
81561 [KELS6P 22.000]	81571 [KELS7P 22.000]	1	0.00000	0.00010	0.00000	0	0	0
81562 [KELS6Q 22.000]	81572 [KELS7Q 22.000]	1	0.00000	0.00010	0.00000	0	0	0
82020 [KILR2- 275.00]	90020 [TAND2- 275.00]	1	0.00410	0.03540	0.21490	881	820	710
82531 [KNCK3A 33.000]	82532 [KNCK3B 33.000]	1	0.00000	0.00010	0.00000	1000	1000	1000
84011 [LISB1A 110.00]	90011 [TAND1A 110.00]	1	0.03910	0.10850	0.01040	103	95	82
84012 [LISB1B 110.00]	90011 [TAND1A 110.00]	1	0.03370	0.10600	0.00940	100	93	80
85020 [MAGF2- 275.00]	90020 [TAND2- 275.00]	1	0.00260	0.02150	0.13950	881	820	820
85020 [MAGF2- 275.00]	90020 [TAND2- 275.00]	2	0.00260	0.02150	0.13950	881	820	820
86031 [MOUN3A 33.000]	86032 [MOUN3B 33.000]	1	0.00000	0.00010	0.00000	1000	1000	1000
86511 [NEWY1A 110.00]	90011 [TAND1A 110.00]	1	0.03480	0.07960	0.00840	103	95	82
86512 [NEWY1B 110.00]	90011 [TAND1A 110.00]	1	0.03480	0.07960	0.00840	103	95	82
87510 [OMAH1- 110.00]	89510 [STRA1- 110.00]	1	0.05150	0.12250	0.01170	103	95	82
87510 [OMAH1- 110.00]	89510 [STRA1- 110.00]	2	0.05320	0.12660	0.01210	103	95	82
89030 [SKEG3- 33.000]	91031 [WEST3A 33.000]	1	0.02600	0.26760	0.00300	33	33	30
89030 [SKEG3- 33.000]	91032 [WEST3B 33.000]	1	0.01820	0.26880	0.00300	33	33	30
90011 [TAND1A 110.00]	90012 [TAND1B 110.00]	1	0.00000	0.00010	0.00000	1000	1000	1000
90012 [TAND1B 110.00]	90511 [WARN1A 110.00]	1	0.01280	0.04180	0.00440	113	96	80
90012 [TAND1B 110.00]	90512 [WARN1B 110.00]	1	0.01280	0.04180	0.00440	113	96	80
90061 [TAND6P 22.000]	90071 [TAND7P 22.000]	1	0.00000	0.00010	0.00000	0	0	0
90062 [TAND6Q 22.000]	90072 [TAND7Q 22.000]	1	0.00000	0.00010	0.00000	0	0	0
90063 [TAND6R 22.000]	90073 [TAND7R 22.000]	1	0.00000	0.00010	0.00000	0	0	0
91031 [WEST3A 33.000]	91032 [WEST3B 33.000]	1	0.00400	0.21260	0.00000	38	38	38

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM DATA LISTING

BRANCH DATA CHANGES - WINTER 2006/07-20012/13 Table 5

BASE YEAR CIRCUITS MODIFIED

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE			RATING IN MVA		
			RESISTANCE	REACTANCE	SUSCEPTANCE	WINTER	AUTUMN	SUMMER
75510 [COOL1- 110.00]	89510 [STRA1- 110.00]	1	0.018	0.0517	0.0169	166	158	144
75510 [COOL1- 110.00]	89510 [STRA1- 110.00]	2	0.0182	0.0786	0.0084	166	158	144
75912 [CREC1B 110.00]	77510 [DUNG1- 110.00]	1	0.04727	0.12489	0.01733	103	95	82
75911 [CREC1A 110.00]	81510 [KELS1- 110.00]	1	0.02923	0.07642	0.01283	103	95	82

2007 SUMMER CIRCUITS ADDED

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE			RATING IN MVA		
			RESISTANCE	REACTANCE	SUSCEPTANCE	WINTER	AUTUMN	SUMMER
79010 [ENNK1_ 110.00]	79011 [DERRYLIN 110.00]	1	0.03918	0.10365	0.00994	124	119	109

2007/08 WINTER CIRCUITS MODIFIED

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE			RATING IN MVA		
			RESISTANCE	REACTANCE	SUSCEPTANCE	WINTER	AUTUMN	SUMMER
75010 [COLE1- 110.00]	81510 [KELS1- 110.00]	1	0.0701	0.2008	0.0198	124	95	82
75911 [CREC1A 110.00]	81510 [KELS1- 110.00]	1	0.02243	0.07506	0.01303	103	95	82

2008 SUMMER CIRCUITS DELETED

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE			RATING IN MVA		
			RESISTANCE	REACTANCE	SUSCEPTANCE	WINTER	AUTUMN	SUMMER
85020 [MAGF2- 275.00]	90020 [TAND2- 275.00]	1	0.0026	0.0215	0.1395	881	820	710

2008 SUMMER CIRCUITS ADDED

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE			RATING IN MVA		
			RESISTANCE	REACTANCE	SUSCEPTANCE	WINTER	AUTUMN	SUMMER
85020 [MAGF2- 275.00]	90320 [DRUMKEE2- 275.00]	1	0.0013	0.01075	0.06975	881	820	710
90020 [TAND2- 275.00]	90320 [DRUNKEE2- 275.00]	1	0.013	0.01075	0.06975	881	820	710
77510 [DUNG1- 110.00]	90310 [DRUNKEE1- 110.00]	1	0.00387	0.01454	0.0063	166	158	144

2009/10 WINTER CIRCUITS MODIFIED

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE			RATING IN MVA		
			RESISTANCE	REACTANCE	SUSCEPTANCE	WINTER	AUTUMN	SUMMER
75010 [COLE1- 110.00]	75510 [COOL1- 110.00]	1	0.035	0.1519	0.0161	166	95	82

2010/11 WINTER CIRCUITS MODIFIED

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE			RATING IN MVA		
			RESISTANCE	REACTANCE	SUSCEPTANCE	WINTER	AUTUMN	SUMMER
75510 [COOL1- 110.00]	83510 [LIMA1- 110.00]	1	0.0226	0.0976	0.0104	166	95	82

2012 SUMMER CIRCUITS ADDED

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE			RATING IN MVA		
			RESISTANCE	REACTANCE	SUSCEPTANCE	WINTER	AUTUMN	SUMMER
3774 [MIDCAVAN 380.00]	90340 [DRUMKEE4 380.00]	1	0.0016	0.0183	0.4139	1713	1713	1713

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM DATA LISTING TRANSFORMER DATA - WINTER 2006/07 Table 6										
From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE		RATING IN MVA			UPPER PU OFF NOMINAL RATIO	LOWER PU OFF NOMINAL RATIO	NUMBER OF TAP
			RESISITANCE	REACTANCE	WINTER	AUTUMN	SUMMER			
3522 [LOUTH 220.00]	35231 [LOUTH5 A 275.00]	1	0.0000	0.0303	300	300	300	1.157	0.850	23
3522 [LOUTH 220.00]	35231 [LOUTH5 A 275.00]	2	0.0000	0.0303	300	300	300	1.157	0.850	23
3522 [LOUTH 220.00]	35232 [LOUTH5 B 275.00]	3	0.0000	0.0152	600	600	600	1.157	0.850	23
70011 [ANTR1A 110.00]	70030 [ANTR3- 33.000]	1	0.0268	0.4440	22.5	22.5	22.5	1.100	0.900	15
70011 [ANTR1A 110.00]	70030 [ANTR3- 33.000]	2	0.0268	0.4440	22.5	22.5	22.5	1.100	0.900	15
70012 [ANTR1B 110.00]	70030 [ANTR3- 33.000]	1	0.0268	0.4440	22.5	22.5	22.5	1.100	0.900	15
70012 [ANTR1B 110.00]	70030 [ANTR3- 33.000]	2	0.0268	0.4440	22.5	22.5	22.5	1.100	0.900	15
70504 [BAFDG4 15.000]	70520 [BAFD2- 275.00]	1	0.0012	0.0729	240	240	240	1.248	1.021	15
70505 [BAFDG5 15.000]	70520 [BAFD2- 275.00]	1	0.0012	0.0729	240	240	240	1.248	1.021	15
70506 [BAFDG6 15.000]	70520 [BAFD2- 275.00]	1	0.0012	0.0729	240	240	240	1.248	1.021	15
70507 [BAFDG7 11.000]	70510 [BAFD1- 110.00]	1	0.0068	0.2000	75	75	75	1.200	0.982	15
70508 [BAFDG8 11.000]	70510 [BAFD1- 110.00]	1	0.0068	0.2000	75	75	75	1.200	0.982	15
70510 [BAFD1- 110.00]	70516 [BAFD_GD 15.000]	1	0.0037	0.1326	135	135	135	1.175	0.875	25
70510 [BAFD1- 110.00]	70580 [BAFD8- 3.3000]	1	0.0081	0.2867	75	75	75	1.500	0.510	159
70513 [BAFD_GA 15.000]	70520 [BAFD2- 275.00]	1	0.0023	0.0816	217	217	217	1.171	0.866	25
70514 [BAFD_GB 15.000]	70520 [BAFD2- 275.00]	1	0.0023	0.0816	217	217	217	1.171	0.866	25
70515 [BAFD_GC 18.000]	70520 [BAFD2- 275.00]	1	0.0020	0.0712	250	250	250	1.171	0.866	25
71011 [BAME1A 110.00]	71031 [BAME3R 33.000]	1	0.0132	0.2384	45	45	45	1.100	0.850	16
71011 [BAME1A 110.00]	71032 [BAME3T 33.000]	1	0.0116	0.2780	45	45	45	1.100	0.800	19
71012 [BAME1B 110.00]	71031 [BAME3R 33.000]	1	0.0132	0.2384	45	45	45	1.100	0.850	16
71012 [BAME1B 110.00]	71032 [BAME3T 33.000]	1	0.0116	0.2780	45	45	45	1.100	0.800	19
71511 [BANB1A 110.00]	71530 [BANB3- 33.000]	1	0.0168	0.4102	30	30	30	1.100	0.900	15
71511 [BANB1A 110.00]	71530 [BANB3- 33.000]	2	0.0168	0.4102	30	30	30	1.100	0.900	15
71512 [BANB1B 110.00]	71530 [BANB3- 33.000]	1	0.0168	0.4102	30	30	30	1.100	0.900	15
71512 [BANB1B 110.00]	71530 [BANB3- 33.000]	2	0.0168	0.4102	30	30	30	1.100	0.900	15

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM DATA LISTING

TRANSFORMER DATA - WINTER 2006/07 Table 6

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE		RATING IN MVA			UPPER PU OFF NOMINAL RATIO	LOWER PU OFF NOMINAL RATIO	NUMBER OF TAP
			RESISITANCE	REACTANCE	WINTER	AUTUMN	SUMMER			
72511 [BNCH1A 110.00]	72530 [BNCH3- 33.000]	1	0.0038	0.2419	90	90	90	1.100	0.800	19
72512 [BNCH1B 110.00]	72530 [BNCH3- 33.000]	1	0.0038	0.2419	90	90	90	1.100	0.800	19
74011 [CARN1A 110.00]	74030 [CARN3- 33.000]	1	0.0111	0.2854	60	60	60	1.150	0.850	19
74012 [CARN1B 110.00]	74030 [CARN3- 33.000]	1	0.0306	0.5956	30	30	30	1.150	0.850	19
74012 [CARN1B 110.00]	74030 [CARN3- 33.000]	2	0.0306	0.5956	30	30	30	1.150	0.850	19
74711 [CENT1A 110.00]	74731 [CENT3A 33.000]	1	0.0060	0.2424	90	90	90	1.150	0.850	19
74712 [CENT1B 110.00]	74732 [CENT3B 33.000]	1	0.0060	0.2424	90	90	90	1.150	0.850	19
75010 [COLE1- 110.00]	75030 [COLE3- 33.000]	1	0.0074	0.2500	60	60	60	1.100	0.800	19
75010 [COLE1- 110.00]	75030 [COLE3- 33.000]	2	0.0074	0.2500	60	60	60	1.100	0.800	19
75508 [COOLG8- 11.000]	75510 [COOL1- 110.00]	1	0.0068	0.2000	75	75	75	1.200	0.982	15
75510 [COOL1- 110.00]	75515 [COOLST- 11.800]	1	0.0026	0.0634	200	200	200	1.200	0.982	15
75510 [COOL1- 110.00]	75530 [COOL3- 33.000]	1	0.0086	0.2556	90	90	90	1.100	0.800	19
75510 [COOL1- 110.00]	75530 [COOL3- 33.000]	2	0.0086	0.2556	90	90	90	1.100	0.800	19
75516 [COOLGT- 16.000]	75520 [COOL2- 275.00]	1	0.0015	0.0432	300	300	300	1.187	0.971	15
75810 [CREA1- 110.00]	75830 [CREA3- 33.000]	1	0.0110	0.2740	60	60	60	1.100	0.800	19
75810 [CREA1- 110.00]	75830 [CREA3- 33.000]	2	0.0110	0.2740	60	60	60	1.100	0.800	19
76011 [CREG1A 110.00]	76031 [CREG3A 33.000]	1	0.0118	0.3200	75	75	75	1.150	0.850	19
76012 [CREG1B 110.00]	76031 [CREG3A 33.000]	1	0.0118	0.3200	75	75	75	1.150	0.850	19
76511 [DONE1C 110.00]	76532 [DONE3N 33.000]	1	0.0060	0.2424	90	90	90	1.150	0.850	19
76512 [DONE1B 110.00]	76532 [DONE3N 33.000]	1	0.0210	0.3670	60	60	60	1.150	0.850	19
76513 [DONE1D 110.00]	76531 [DONE3AS 33.000]	1	0.0210	0.3670	60	60	60	1.150	0.850	19
76514 [DONE1A 110.00]	76531 [DONE3AS 33.000]	1	0.0210	0.3670	60	60	60	1.150	0.850	19
77010 [DRUM1- 110.00]	77030 [DRUM3- 33.000]	1	0.0060	0.2424	90	90	90	1.100	0.800	19
77010 [DRUM1- 110.00]	77030 [DRUM3- 33.000]	2	0.0060	0.2424	90	90	90	1.100	0.800	19
77510 [DUNG1- 110.00]	77530 [DUNG3- 33.000]	1	0.0086	0.2582	90	90	90	1.100	0.800	19
77510 [DUNG1- 110.00]	77530 [DUNG3- 33.000]	2	0.0086	0.2582	90	90	90	1.100	0.800	19

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM DATA LISTING TRANSFORMER DATA - WINTER 2006/07 Table 6										
From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE		RATING IN MVA			UPPER PU OFF	LOWER PU OFF	NUMBER OF
			RESISITANCE	REACTANCE	WINTER	AUTUMN	SUMMER	NOMINAL RATIO	NOMINAL RATIO	TAP
78511 [EDEN1A 110.00]	78530 [EDEN3- 33.000]	1	0.0110	0.2740	45	45	45	1.100	0.800	19
78512 [EDEN1B 110.00]	78530 [EDEN3- 33.000]	1	0.0110	0.2740	45	45	45	1.100	0.800	19
79010 [ENNK1_ 110.00]	79015 [ENNKPFA 110.00]	1	0.0020	0.0213	125	125	125	45.000	-45.000	9999
79010 [ENNK1_ 110.00]	79030 [ENNK3- 33.000]	1	0.0120	0.2660	45	45	45	1.150	0.850	19
79010 [ENNK1_ 110.00]	79030 [ENNK3- 33.000]	2	0.0120	0.2660	45	45	45	1.150	0.850	19
79010 [ENNK1_ 110.00]	79030 [ENNK3- 33.000]	3	0.0074	0.2500	60	60	60	1.100	0.800	19
79015 [ENNKPFA 110.00]	79016 [ENNKPFB 110.00]	1	0.0000	0.0213	125	125	125	1.227	0.774	35
80011 [FINY1A 110.00]	80030 [FINY3- 33.000]	1	0.0076	0.2533	45	45	45	1.100	0.800	19
80012 [FINY1B 110.00]	80030 [FINY3- 33.000]	1	0.0076	0.2533	45	45	45	1.100	0.800	19
80511 [GLEN1A 110.00]	80531 [GLEN3A 33.000]	1	0.0111	0.3380	60	60	60	1.150	0.850	19
82001 [KILRG1- 17.000]	82020 [KILR2- 275.00]	1	0.0007	0.0488	340	340	340	1.224	0.890	19
82002 [KILRG2- 17.000]	82020 [KILR2- 275.00]	1	0.0007	0.0488	340	340	340	1.224	0.890	19
82511 [KNCK1A 110.00]	82531 [KNCK3A 33.000]	1	0.0120	0.3370	60	60	60	1.150	0.850	19
82512 [KNCK1B 110.00]	82532 [KNCK3B 33.000]	1	0.0120	0.3370	60	60	60	1.150	0.850	19
83011 [LARN1A 110.00]	83030 [LARN3- 33.000]	1	0.0116	0.2780	45	45	45	1.100	0.900	15
83012 [LARN1B 110.00]	83030 [LARN3- 33.000]	1	0.0116	0.2780	45	45	45	1.100	0.900	15
83510 [LIMA1- 110.00]	83530 [LIMA3- 33.000]	1	0.0124	0.2778	45	45	45	1.500	0.510	15
83510 [LIMA1- 110.00]	83530 [LIMA3- 33.000]	2	0.0124	0.2778	45	45	45	1.500	0.510	15
84011 [LISB1A 110.00]	84030 [LISB3- 33.000]	1	0.0086	0.2550	90	90	90	1.100	0.800	19
84012 [LISB1B 110.00]	84030 [LISB3- 33.000]	1	0.0086	0.2550	90	90	90	1.100	0.800	19
84411 [LSMR1A 110.00]	84430 [LSMR3- 33.000]	1	0.0076	0.2533	45	45	45	1.100	0.800	19
84412 [LSMR1B 110.00]	84430 [LSMR3- 33.000]	1	0.0076	0.2533	45	45	45	1.100	0.800	19
84511 [LOGE1A 110.00]	84530 [LOGE3- 33.000]	1	0.0126	0.2800	45	45	45	1.100	0.800	19
84512 [LOGE1B 110.00]	84530 [LOGE3- 33.000]	1	0.0126	0.2800	45	45	45	1.100	0.800	19
86311 [NARD1A 110.00]	86330 [NARD3- 33.000]	1	0.0100	0.2500	60	60	60	1.100	0.800	19
86312 [NARD1B 110.00]	86330 [NARD3- 33.000]	1	0.0100	0.2500	60	60	60	1.100	0.800	19

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM DATA LISTING

TRANSFORMER DATA - WINTER 2006/07 **Table 6**

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE		RATING IN MVA			UPPER PU OFF	LOWER PU OFF	NUMBER OF
			RESISITANCE	REACTANCE	WINTER	AUTUMN	SUMMER	NOMINAL RATIO	NOMINAL RATIO	TAP
86511 [NEWY1A 110.00]	86530 [NEWY3- 33.000]	1	0.0038	0.2419	90	90	90	1.100	0.800	19
86512 [NEWY1B 110.00]	86530 [NEWY3- 33.000]	1	0.0038	0.2419	90	90	90	1.100	0.800	19
87011 [NORF1A 110.00]	87030 [NORF3- 33.000]	1	0.0124	0.2778	45	45	45	1.500	0.510	159
87012 [NORF1B 110.00]	87030 [NORF3- 33.000]	1	0.0124	0.2778	45	45	45	1.500	0.510	159
87510 [OMAH1- 110.00]	87530 [OMAH3- 33.000]	1	0.0074	0.2500	60	60	60	1.100	0.800	19
87510 [OMAH1- 110.00]	87530 [OMAH3- 33.000]	2	0.0074	0.2500	60	60	60	1.100	0.800	19
88011 [RATH1A 110.00]	88030 [RATH3- 33.000]	1	0.0086	0.2554	90	90	90	1.100	0.800	19
88012 [RATH1B 110.00]	88030 [RATH3- 33.000]	1	0.0086	0.2554	90	90	90	1.100	0.800	19
88511 [ROSE1A 110.00]	88530 [ROSE3- 33.000]	1	0.0086	0.2554	90	90	90	1.100	0.800	19
88512 [ROSE1B 110.00]	88530 [ROSE3- 33.000]	1	0.0086	0.2554	90	90	90	1.100	0.800	19
89510 [STRA1- 110.00]	89515 [STRPFCA 110.00]	1	0.0020	0.0213	125	125	125	45.000	-45.000	9999
89510 [STRA1- 110.00]	89530 [STRA3- 33.000]	1	0.0078	0.2500	45	45	45	1.100	0.800	19
89510 [STRA1- 110.00]	89530 [STRA3- 33.000]	2	0.0078	0.2500	45	45	45	1.100	0.800	19
89515 [STRPFCA 110.00]	89516 [STRPFCB 110.00]	1	0.0000	0.0213	125	125	125	1.227	0.774	35
90511 [WARN1A 110.00]	90530 [WARN3- 33.000]	1	0.0120	0.3000	45	45	45	1.100	0.800	19
90512 [WARN1B 110.00]	90530 [WARN3- 33.000]	1	0.0120	0.3000	45	45	45	1.100	0.800	19
91011 [WEST1A 110.00]	91031 [WEST3A 33.000]	1	0.0074	0.1670	75	75	75	1.150	0.850	19
91012 [WEST1B 110.00]	91032 [WEST3B 33.000]	1	0.0074	0.1670	75	75	75	1.150	0.850	19

Note - The above ratings are nominal. For transformers less than 25 years old we allow overload ratings depending on the season of the year (ambient temperature), These are taken into account in our analysis in Table 2.

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM DATA LISTING

TRANSFORMER DATA CHANGES - WINTER 2006/07-2012/13 Table 7

BASE YEAR B.S.P. TRANSFORMERS REPLACED

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE		RATING IN MVA			UPPER	LOWER	NUMBER OF
			RESISITANCE	REACTANCE	WINTER	AUTUMN	SUMMER	PU OFF	PU OFF	TAP POSITIONS
83510 [LIMA1- 110.00]	83530 [LIMA3- 33.000]	1	0.0124	0.2778	45	45	45	1.5	0.51	15
83510 [LIMA1- 110.00]	83530 [LIMA3- 33.000]	2	0.0124	0.2778	45	45	45	1.5	0.51	15

2007 SUMMER B.S.P. TRANSFORMERS ADDED

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE		RATING IN MVA			UPPER	LOWER	NUMBER OF
			RESISITANCE	REACTANCE	WINTER	AUTUMN	SUMMER	PU OFF	PU OFF	TAP POSITIONS
79011 [DERRYLIN 110.00]	79034 [QUINNS 33.000]	1	0.00372	0.2419	90	90	90	1.03	1.01	19

2007/08 WINTER B.S.P. TRANSFORMERS REPLACED

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE		RATING IN MVA			UPPER	LOWER	NUMBER OF
			RESISITANCE	REACTANCE	WINTER	AUTUMN	SUMMER	PU OFF	PU OFF	TAP POSITIONS
70011 [ANTR1A 110.00]	70030 [ANTR3- 33.000]	1	0.00377	0.2419	90	90	90	1.03	1.01	19
70012 [ANTR1B 110.00]	70030 [ANTR3- 33.000]	1	0.00377	0.2419	90	90	90	1.03	1.01	19
71011 [BAME1A 110.00]	71031 [BAME3R 33.000]	1	0.00377	0.2419	90	90	90	1.03	1.01	19
71012 [BAME1B 110.00]	71031 [BAME3R 33.000]	1	0.00377	0.2419	90	90	90	1.03	1.01	19

2007/08 WINTER B.S.P. TRANSFORMERS DELETED

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE		RATING IN MVA			UPPER	LOWER	NUMBER OF
			RESISITANCE	REACTANCE	WINTER	AUTUMN	SUMMER	PU OFF	PU OFF	TAP POSITIONS
70011 [ANTR1A 110.00]	70030 [ANTR3- 33.000]	2	0.0268	0.444	22.5	27	22.5	1.03	1.01	15
70012 [ANTR1B 110.00]	70030 [ANTR3- 33.000]	2	0.0268	0.444	22.5	27	22.5	1.03	1.01	15

2008/09 WINTER B.S.P. TRANSFORMERS DELETED

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE		RATING IN MVA			UPPER	LOWER	NUMBER OF
			RESISITANCE	REACTANCE	WINTER	AUTUMN	SUMMER	PU OFF	PU OFF	TAP POSITIONS
91011 [WEST1A 110.00]	91031 [WEST3A 33.000]	1	0.0074	0.167	75	75	75	1.03	1.01	19
91012 [WEST1B 110.00]	91032 [WEST3B 33.000]	1	0.0074	0.167	75	75	75	1.03	1.01	19
74012 [CARN1B 110.00]	74030 [CARN3- 33.000]	2	0.0306	0.5956	30	30	30	1.03	1.01	19

2008/09 WINTER B.S.P. TRANSFORMERS ADDED

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE		RATING IN MVA			UPPER	LOWER	NUMBER OF
			RESISITANCE	REACTANCE	WINTER	AUTUMN	SUMMER	PU OFF	PU OFF	TAP POSITIONS
91011 [BNMN1A 110.00]	91032 [BNMN3B 33.000]	1	0.00377	0.2419	90	90	90	1.03	1.01	19
91012 [BNMN1B 110.00]	91032 [BNMN3B 33.000]	1	0.00377	0.2419	90	90	90	1.03	1.01	19

2008/09 WINTER B.S.P. TRANSFORMERS REPLACED

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE		RATING IN MVA			UPPER	LOWER	NUMBER OF
			RESISITANCE	REACTANCE	WINTER	AUTUMN	SUMMER	PU OFF	PU OFF	TAP POSITIONS
74011 [CARN1A 110.00]	74030 [CARN3- 33.000]	1	0.0111	0.2854	60	60	60	1.03	1.01	19
74012 [CARN1B 110.00]	74030 [CARN3- 33.000]	1	0.0306	0.5956	30	30	30	1.03	1.01	19
90511 [WARN1A 110.00]	90530 [WARN3- 33.000]	1	0.00377	0.2419	90	90	90	1.03	1.01	19
90512 [WARN1B 110.00]	90530 [WARN3- 33.000]	1	0.00377	0.2419	90	90	90	1.03	1.01	19

2009/10 WINTER B.S.P. TRANSFORMERS REPLACED

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE		RATING IN MVA			UPPER	LOWER	NUMBER OF
			RESISITANCE	REACTANCE	WINTER	AUTUMN	SUMMER	PU OFF	PU OFF	TAP POSITIONS
82511 [KNCK1A 110.00]	82531 [KNCK3A 33.000]	1	0.00377	0.2419	90	90	90	1.03	1.01	19
82512 [KNCK1B 110.00]	82532 [KNCK3B 33.000]	1	0.00377	0.2419	90	90	90	1.03	1.01	19

2010/11 WINTER B.S.P. TRANSFORMERS REPLACED

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE		RATING IN MVA			UPPER	LOWER	NUMBER OF
			RESISITANCE	REACTANCE	WINTER	AUTUMN	SUMMER	PU OFF	PU OFF	TAP POSITIONS
76011 [CREG1A 110.00]	76031 [CREG3A 33.000]	1	0.00377	0.2419	90	90	90	1.03	1.01	19
76012 [CREG1B 110.00]	76031 [CREG3A 33.000]	1	0.00377	0.2419	90	90	90	1.03	1.01	19

2011/12 WINTER B.S.P. TRANSFORMERS REPLACED

From Bus Number/Name	To Bus Number/Name	Id	PARAMETERS PU ON 100MVA BASE		RATING IN MVA			UPPER	LOWER	NUMBER OF
			RESISITANCE	REACTANCE	WINTER	AUTUMN	SUMMER	PU OFF	PU OFF	TAP POSITIONS
76514 [DONE1A 110.00]	76531 [DONE3AS 33.000]	1	0.00377	0.2419	90	90	90	1.03	1.01	19

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM DATA LISTING

275/110kV INTERBUS TRANSFORMER - WINTER 2006/07-2012/13 **Table 8**

From Bus Number/Name	To Bus Number/Name	Last Bus Number/Name	Id	PARAMETERS PU ON 100 MVA BASE						RATING IN MVA			UPPER PU - OFF NOMINAL RATIO	LOWER PU - OFF NOMINAL RATIO	NO. OF TAP POS.
				W1-2 R	W1-2 X	W2-3 R	W2-3 X	W3-1 R	W3-1 X	W1	W2	W3			
70510 [BAFD1- 110.00]	70520 [BAFD2- 275.00]	70561 [BAFD6P 22.000]	1	0.0018	0.0641	0.0018	0.2092	0.0000	0.1325	240	240	30	1.15	0.85	19
70510 [BAFD1- 110.00]	70520 [BAFD2- 275.00]	70562 [BAFD6Q 22.000]	1	0.0018	0.0641	0.0018	0.2059	0.0000	0.1280	240	240	30	1.15	0.85	19
74511 [CAST1A 110.00]	74520 [CAST2- 275.00]	74561 [CAST6P 22.000]	1	0.0018	0.0641	0.0018	0.2092	0.0000	0.1325	240	240	30	1.15	0.85	19
74511 [CAST1A 110.00]	74520 [CAST2- 275.00]	74562 [CAST6Q 22.000]	1	0.0018	0.0641	0.0018	0.2092	0.0000	0.1325	240	240	30	1.15	0.85	19
74512 [CAST1B 110.00]	74520 [CAST2- 275.00]	74563 [CAST6R 22.000]	1	0.0018	0.0656	0.0018	0.2375	0.0000	0.1593	240	240	30	1.15	0.85	19
75510 [COOL1- 110.00]	75520 [COOL2- 275.00]	75561 [COOL6P 22.000]	1	0.0018	0.0609	0.0018	0.1273	0.0000	0.0570	240	240	30	1.15	0.85	19
75510 [COOL1- 110.00]	75520 [COOL2- 275.00]	75562 [COOL6Q 22.000]	1	0.0018	0.0609	0.0018	0.1273	0.0000	0.0570	240	240	30	1.15	0.85	19
81010 [HANA1A 110.00]	81020 [HANA2A 275.00]	81061 [HANA6P 22.000]	1	0.0018	0.0591	0.0018	0.1261	0.0000	0.0560	240	240	30	1.15	0.85	19
81010 [HANA1A 110.00]	81020 [HANA2A 275.00]	81062 [HANA6Q 22.000]	1	0.0018	0.0591	0.0018	0.1261	0.0000	0.0560	240	240	30	1.15	0.85	19
81510 [KELS1- 110.00]	81520 [KELS2- 275.00]	81561 [KELS6P 22.000]	1	0.0018	0.0609	0.0018	0.1273	0.0000	0.0570	240	240	30	1.15	0.85	19
81510 [KELS1- 110.00]	81520 [KELS2- 275.00]	81562 [KELS6Q 22.000]	1	0.0018	0.0607	0.0018	0.1317	0.0000	0.0570	240	240	30	1.15	0.85	19
90011 [TAND1A 110.00]	90020 [TAND2- 275.00]	90061 [TAND6P 22.000]	1	0.0018	0.0641	0.0018	0.2092	0.0000	0.1325	240	240	30	1.15	0.85	19
90011 [TAND1A 110.00]	90020 [TAND2- 275.00]	90062 [TAND6Q 22.000]	1	0.0018	0.0641	0.0018	0.2092	0.0000	0.1325	240	240	30	1.15	0.85	19
90012 [TAND1B 110.00]	90020 [TAND2- 275.00]	90063 [TAND6R 22.000]	1	0.0018	0.0656	0.0018	0.2375	0.0000	0.1575	240	240	30	1.15	0.85	19

2008 SUMMER INTERBUS TRANSFORMER ADDED

From Bus Number/Name	To Bus Number/Name	Last Bus Number/Name	Id	PARAMETERS PU ON 100 MVA BASE						RATING IN MVA			UPPER PU - OFF NOMINAL RATIO	LOWER PU - OFF NOMINAL RATIO	NO. OF TAP POS.
				W1-2 R	W1-2 X	W2-3 R	W2-3 X	W3-1 R	W3-1 X	W1	W2	W3			
90310 [DRUNKEE1- 110.00]	90320 [DRUNKEE2- 275.00]	90361 [DRUNKEE6P 22.000]	1	0.0018	0.0656	0.0018	0.2375	0.0000	0.1593	240	240	60	1.10	0.90	19

2012 SUMMER INTERBUS TRANSFORMERS ADDED

From Bus Number/Name	To Bus Number/Name	Last Bus Number/Name	Id	PARAMETERS PU ON 100 MVA BASE						RATING IN MVA			UPPER PU - OFF NOMINAL RATIO	LOWER PU - OFF NOMINAL RATIO	NO. OF TAP POS.
				W1-2 R	W1-2 X	W2-3 R	W2-3 X	W3-1 R	W3-1 X	W1	W2	W3			
90340 [DRUMKEE4 380.00]	90320 [DRUMKEE2 275.00]	90363 [DRUMKEE 22.000]	1	0.0008	0.02	0.00	0.0001	0	0.0001	600	600	600	1.1	0.9	23
90340 [DRUMKEE4 380.00]	90320 [DRUMKEE2 275.00]	90364 [DRUMKEE 22.000]	1	0.0008	0.02	0.00	0.0001	0	0.0001	600	600	600	1.1	0.9	23
90340 [DRUMKEE4 380.00]	90320 [DRUMKEE2 275.00]	90365 [DRUMKEE 22.000]	1	0.0008	0.02	0.00	0.0001	0	0.0001	600	600	600	1.1	0.9	23

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM DATA LISTING

275/110kV INTERBUS TRANSFORMER - WINTER 2006/07-2012/13 Table 8

2007/08 SUMMER INTERBUS TRANSFORMERS REPLACED

From Bus Number/Name	To Bus Number/Name	Last Bus Number/Name	Id	PARAMETERS PU ON 100 MVA BASE						RATING IN MVA			UPPER PU - OFF NOMINAL RATIO	LOWER PU - OFF NOMINAL RATIO	NO. OF TAP POS.
				W1-2 R	W1-2 X	W2-3 R	W2-3 X	W3-1 R	W3-1 X	W1	W2	W3			
81010 [HANA1A 110.00]	81020 [HANA2A 275.00]	81061 [HANA6P 22.000]	1	0.00144	0.05248	0.00144	0.19	0	0.12744	300	300	60	1.15	0.85	19

2008/09 SUMMER INTERBUS TRANSFORMERS REPLACED

From Bus Number/Name	To Bus Number/Name	Last Bus Number/Name	Id	PARAMETERS PU ON 100 MVA BASE						RATING IN MVA			UPPER PU - OFF NOMINAL RATIO	LOWER PU - OFF NOMINAL RATIO	NO. OF TAP POS.
				W1-2 R	W1-2 X	W2-3 R	W2-3 X	W3-1 R	W3-1 X	W1	W2	W3			
81010 [HANA1A 110.00]	81020 [HANA2A 275.00]	81062 [HANA6Q 22.000]	1	0.00144	0.05248	0.00144	0.19	0	0.12744	300	300	60	1.15	0.85	19

2009/10 SUMMER INTERBUS TRANSFORMERS ADDED

From Bus Number/Name	To Bus Number/Name	Last Bus Number/Name	Id	PARAMETERS PU ON 100 MVA BASE						RATING IN MVA			UPPER PU - OFF NOMINAL RATIO	LOWER PU - OFF NOMINAL RATIO	NO. OF TAP POS.
				W1-2 R	W1-2 X	W2-3 R	W2-3 X	W3-1 R	W3-1 X	W1	W2	W3			
74511 [CAST1A 110.00]	74520 [CAST2- 275.00]	74561 [CAST6P 22.000]	1	0.00144	0.05248	0.00144	0.19	0	0.12744	300	300	60	1.15	0.85	19

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM DATA LISTING

CAPACITANCE DATA - WINTER 2006/07 **Table 9**

CAPACITANCE INSTALLED AT WINTER 2006/07

BUS NUMBER	NODE NAME	NAME	VOLTAGE (kV)	LOAD (MVAr)	NOTES
74571	CAST7P	CASTLEREAGH	22	25	NOTE 1
74572	CAST7Q		22	25	NOTE 1
74573	CAST7R		22	25	NOTE 1
75514	COOL1C	COOLKEERAGH	110	40	NOTE 1
79030	ENNK3-	ENNISKILLEN	30	30	NOTE 1
86220	MOYL2-	MOYLE	236	236	NOTE 2
90071	TAND7P	TANDRAGEE	25	25	NOTE 1
90073	TAND7R		25	25	NOTE 1

CAPACITANCE ADDED SUMMER 2007

BUS NUMBER	NODE NAME	NAME	VOLTAGE (kV)	LOAD (MVAr)	NOTES
75011	COLE1C	COLERAINE	110	48	NOTE 1

NOTE 1 - Capacitance is switched in as necessary

NOTE 2 - Capacitance varies with transfer (from/to Scotland), 0 - 236MVAr in blocks of 59MVAr

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM SEVEN YEAR STATEMENT 2006 Switchgear Ratings and Fault Levels 2008/09 (With ESB connection) Table 10				
Location	Voltage (kV)	Switchgear Fault rating (MVA)	Calculated Fault Level (MVA)	
			three phase	single phase to earth
Ballylumford	275	15000 note 1	9194	10922
Castlereagh	275	9500	7379	7842
Coolkeeragh	275	9500	5769	6271
Hannahstown	275	15000	7472	7720
Kells	275	9500	8229	8619
Kilroot	275	15000	7925	8222
Magherafelt	275	9500	8221	7483
Moyle	275	15000	8459	10163
Tandragee	275	9500	8513	8590
Tyrone	275	15000	6519	6285
Antrim	110	3500	1882	2069
Ballylumford	110	4200/5000 *note 2, 3*	4505	5471
Ballymena	110	3500	1723	1806
Banbridge	110	3500	1370	1330
Ballyvallagh	110	3500	3092	2833
Ballynahinch	110	3500	1125	1111
Belfast Central	110	6000	3016	3536
Carnmoney	110	3500	1872	1792
Castlereagh	110	6000	3863	4935
Coleraine	110	7600	1534	1663
Coolkeeragh	110	6000	4316	5471
Creagh	110	6000	1532	1155
Cregagh	110	5000 *note 4*	3437	4203
Donegall North	110	6000	2950	3668
Donegall South	110		2230	2384

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM
SEVEN YEAR STATEMENT 2006
Switchgear Ratings and Fault Levels 2008/09 **Table 10**
(With ESB connection)

Location	Voltage	Switchgear Fault rating	Calculated Fault Level (MVA)	
	(kV)	(MVA)	three phase	single phase to earth
Drumnakelly	110	7600	3878	4189
Dungannon	110	3500	3156	3293
Eden	110	3500	2106	2086
Enniskillen	110	3500	1494	1800
Finaghy	110	6000	3063	3900
Glengormley	110	3500	1057	1007
Hannahstown	110	6000	3357	4410
Kells	110	5000	3829	4809
Knock	110	3500	3216	3202
Larne	110	3500	1860	1761
Limavady	110	3500	1394	1364
Lisaghmore	110	3500	1938	1860
Lisburn	110	3500	2050	2126
Loguestown	110	3500	1091	1174
Newry	110	3500	1083	1099
Newtownards	110	6000	1491	1426
Norfil	110	3500	1851	2030
Omagh	110	7600	2409	2416
Rathgael	110	3500	1206	1197
Rosebank	110	3500 note 4	3606	4575
Strabane	110	3500	2885	3027
Tandragee	110	6000	4327	5176
Tyrone	110	6000	2595	2965
Waringstown	110	3500	1623	1536
West	110	3500	2521	2558

The above ratings are based on the lowest rated switchgear, although NIE is carrying out a review of all substation equipment capacities. Fault-level rating could therefore be less than values stated in this table.

note 1 - Switchgear, Current transformers & Line traps have been uprated. Equipment associated with the Interbus Tx's have not. NIE Power Networks are currently investigating the ratings of the associated equipment.
note 2 - 3-phase fault rating - 4200MVA / 1-phase fault rating - 5000MVA.
note 3 - It is planned to uprate substation fault-level in RP4. In the intervening period, the system operator will carry out fault-level reduction measures.
note 4 - Substation has equipment below stated rating. Risk mitigation processes in operation management plan are in place. It is planned to uprate this equipment in RP4

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM

SEVEN YEAR STATEMENT 2006

Capability Matrix for 2012/13Winter - **TABLE 11**

From	Description	To Existing Load	To Republic of Ireland	To Scotland
Ballylumford	a) Incremental Transfer	0MW	0MW	200MW
	b) Problem Outage	Hann-Moyle D/C Bfd-Moyle D/C	Hann-Moyle D/C Bfd-Moyle D/C	Bfd-Moyle D/C
	c) Network Problem	O/L Bfd-Kells O/L Bfd-Han Also Voltage	O/L Bfd-Kells O/L Bfd-Han Also Voltage	Voltage
	d) Work Required	Reconductor + SVC	Reconductor + SVC	SVC
	e) Resulting Transfer	400MW	400MW	400MW
Castlereagh	a) Incremental Transfer	300MW	300MW	200MW
	b) Problem Outage	Hann-Moyle D/C Magh-Kells D/C Bfd-Kells D/C	Hann-Moyle D/C	Bfd-Moyle D/C
	c) Network Problem	Voltage	Voltage	Voltage
	d) Work Required	SVC	SVC	SVC
	e) Resulting Transfer	400MW	400MW	400MW
Coolkeeragh	a) Incremental Transfer	0MW	0MW	0MW
	b) Problem Outage	Cool-Magh D/C Hann-Moyle D/C	Cool-Magh D/C Hann-Moyle D/C	Cool-Magh D/C Bfd-Moyle D/C
	c) Network Problem	110kV O/L in NW Also Voltage	110kV O/L in NW Also Voltage	110kV O/L in NW Also Voltage
	d) Work Required	New 275kV Cool-Magh + SVC	New 275kV Cool-Magh + SVC	New 275kV Cool-Magh + SVC
	e) Resulting Transfer	400MW	400MW	400MW
Drumkee	a) Incremental Transfer	400MW	100MW	0MW
	b) Problem Outage		Hann-Moyle D/C Tand-Drumk D/C	Bfd-Moyle D/C 2 Hann IBTX
	c) Network Problem		O/L Drumkee-Dungannon 110kV Also Voltage	O/L Lisburn-Tandragee 110kV Also Voltage
	d) Work Required		2nd Drumkee-Dungannon 110kV + SVC	Reconductor to UPAS + SVC
	e) Resulting Transfer		400MW	400MW
Kells	a) Incremental Transfer	100MW	100MW	200MW
	b) Problem Outage	Hann-Moyle D/C Magh-Kells D/C	Hann-Moyle D/C Magh-Drumk D/C	Bfd-Moyle D/C
	c) Network Problem	Voltage	Voltage	Voltage
	d) Work Required	SVC	SVC	SVC
	e) Resulting Transfer	400MW	400MW	400MW

NORTHERN IRELAND ELECTRICITY TRANSMISSION SYSTEM

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Capability Matrix for 2012/13Winter - TABLE 11

From	Description	To Existing Load	To Republic of Ireland	To Scotland
Kilroot	a) Incremental Transfer	100MW	100MW	200MW
	b) Problem Outage	Hann-Moyle D/C	Hann-Moyle D/C Magh-Drumk D/C	Bfd-Moyle D/C
	c) Network Problem	Voltage	Voltage	Voltage
	d) Work Required	SVC	SVC	SVC
	e) Resulting Transfer	400MW	400MW	400MW
Magherafelt	a) Incremental Transfer	100MW	100MW	0MW
	b) Problem Outage	Magh-Drumk D/C Hann-Moyle D/C	Tand-Drumk D/C Hann-Moyle D/C	Bfd-Moyle D/C 2 Hann IBTX
	c) Network Problem	Voltage	O/L Drumkee-Dungannon 11kV Also Voltage	O/L Lisburn-Tandragee 110kV Also Voltage
	d) Work Required	SVC	2nd Drumkee-Dungannon 110kV +SVC	Reconductor to UPAS + SVC
	e) Resulting Transfer	400MW	400MW	400MW
Moyle	a) Incremental Transfer	0MW	0MW	400MW
	b) Problem Outage	Hann-Moyle D/C Bfd-Kells D/C	Hann-Moyle D/C Bfd-Kells D/C	
	c) Network Problem	O/L Bfd-Kells O/L Bfd-Han Also Voltage	O/L Bfd-Kells O/L Bfd-Han Also Voltage	
	d) Work Required	Reconductor + SVC	Reconductor + SVC	
	e) Resulting Transfer	400MW	400MW	
Tandragee	a) Incremental Transfer	400MW	300MW	0MW
	b) Problem Outage		Hann-Moyle D/C	Bfd-Moyle D/C 2 Hann IBTX
	c) Network Problem		Voltage	O/L Lisburn-Tandragee 110kV Also Voltage
	d) Work Required		SVC	Reconductor to UPAS + SVC
	e) Resulting Transfer		400MW	400MW

Note: Bfd = Ballylumford; Cool = Coolkeeragh; Han = Hannahstown; Magh = Magherafelt; Drumk = Drumkee; Tand = Tandragee

Licence (System Security & Planning) Standards – Table 12

ER P2/5	Security of Supply, dated October 1978, and NIE amendment sheet Issue 2, dated 7 August 1992
PLM-SP-1	Planning Standards of security for the Connection of Generating Stations to the System Issue 1, dated September 1975, and NIE amendment sheet Issue 2, dated 7 August 1992.
PLM-ST-4	CEGB Criteria for System Transient Stability Studies Issue 1, dated September 1975, and NIE amendment sheet Issue 2, dated 7 August 1992.
PLM-ST-9	Voltage Criteria for the Design of the 400kV and 275kV Supergrid System Issue 1, dated 1 December, 1985, and NIE amendment sheet Issue 2, dated 7 August 1992.
ER-P28	Planning limits for Voltage Fluctuations.
ER-P16	EHV or HV Supplies to Induction Furnaces.
ER-P29	Planning limits for Voltage Unbalance.
ER-G5/3	Limits for Harmonics. (Shortly to be replaced by ER-G 5/4 following UK practice and in conjunction with a joint review with EirGrid)
EPM-1	Operational Standards of Security of Supply, dated November 2004.

GLOSSARY

AAAC	All Aluminium Alloy Conductor
AC	Alternating Current
ACS	Average Cold Spell
BETTA	British Electricity Trading and Transmission Arrangements
BSP	Bulk Supply Point
CCGT	Combined Cycle Gas Turbine
DCMNR	Department of Communications, Marine & Natural Resources
DETI	Department of Enterprise Trade & Investment
Demand Customer	A large customer connected to the transmission system
D/C	Double Circuit
DC	Direct Current
DNC	Declared Net Capacity
ESB	Electricity Supply Board
EU	European Union
FACTS	Flexible AC Transmission System
HVDC	High Voltage Direct Current
IME	Internal Market for Electricity
IPP	Independent Power Producer
kV	Kilo Volts
MVA	Mega Volt-Amperes
NFFO	Non-Fossil Fuel Obligation
NGET	National Grid Electricity Transmission
NI	Northern Ireland
NIAER	Northern Ireland Authority for Energy Regulation
NIE	Northern Ireland Electricity
NTC	Net Transfer Capacity
OCGT	Open Cycle Gas Turbine
PPB	Power Procurement Business
PU	Per Unit
RoI	Republic of Ireland
RP	Review Period
SONI	System Operator for Northern Ireland
SPS	Special Protection Scheme
SSSA	System Support Services Agreement
STATCOM	Static Compensator
SVC	Static Var Compensator
TUOS	Transmission Use of System