SONI LTD

SEVEN YEAR GENERATION CAPACITY STATEMENT

2005/06 – 2011/12

May 2005

SONI Ltd

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For the years 2005/06 to 2011/12

The information used to compile this statement is derived from SONI's own data. Whilst all reasonable care has been taken in the preparation of this data, SONI is not responsible for any loss that may be attributed to the use of this information.

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EXECUTIVE SUMMARY

This 2005 Seven Year Generation Capacity Statement has been produced by SONI Ltd at the request of the Northern Ireland Authority for Energy Regulation (NIAER).

The Statement reflects the generation capacity position from the spring of 2005 and includes committed generation developments for the period to 2011/12. It takes into account a new 414MW Combined Cycle Gas Turbine (CCGT) at Coolkeeragh and recently installed CCGT plant and contractual changes at Ballylumford (a generating unit at Ballylumford contracted to provide capacity for RoI is not counted in NI capacity). The Statement provides two scenarios, one based on high generator availability that also allows a small credit to wind generation (30MW credit for the 150MW installed in 2005/06) and a second scenario based on lower generator availability.

The available transfer capacity to RoI is 330MW by synchronous interconnection. Some trades from GB on the Moyle High Voltage Direct Current (HVDC) Interconnector pass through the NI transmission system to RoI as does a percentage of the output of the Coolkeeragh CCGT. The entire capacity of Moyle and Coolkeeragh CCGT is treated as being useable in NI under plant shortfall conditions. This is consistent with the methodology adopted by ESB National Grid for the treatment of trades across the North-South interconnector.

To achieve full capacity of the Moyle to supplement market import flows SONI can purchase energy under a Balancing & Services Agreement with National Grid Transco and this includes a facility to increase the capacity of the Moyle Interconnector to 450MW in emergency conditions. Purchases of energy from GB are dependent on system and market conditions. For the purposes of this capacity assessment it is assumed that there would be capacity available in a GB system with 70TW of installed generation capacity.

TSO/TSO arrangements are increasingly important in securing inter-area rescue flows. Co-operation between the TSO's in GB, NI and RoI needs to be at a high level to ensure optimised security of supply.

Operating at the generation security standard implies that load shedding may be anticipated to occur every 1.43 years. This standard equates to circa 9 hours loss of load expectation and does not consider the actual level of demand not met. This is consistent with other utilities, for example ESB National Grid.

The ratio of generating unit sizes to peak demand is now higher than previously. There are also a lower number of generating units on the

Northern Ireland System. This increases the potential for loss of supply to customers and tighter margins during planned generation outages. Any degradation of the high historic levels of availability will impact on security of supply.

The Statement concludes that the committed levels of generation capacity operating at high availability levels together with reliance on full import capability from GB, comply with the generation security standard adopted to meet forecasted NI demand. However the increased generation unit sizes and the dependency on imports translate into a higher level of risk that more extensive load shedding may occur.

1. INTRODUCTION

This is the second statement of future generation capacity requirements made by SONI Ltd, the Northern Ireland Transmission System Operator at the request of the Northern Ireland Authority for Energy Regulation (NIAER).

It covers the next seven years from 2005/06 to 2011/12 and shows projections of demand and generation capacity for those years. It discusses the generation security standard and assesses the ability of the capacity to meet demand to that standard.

Previous Seven Year Generation Capacity Statements included a section setting out a centralised plan to address any capacity shortfalls. Under the Electricity (NI) Order 1992 as amended by the Energy (NI) Order 2003, the Department of Enterprise, Trade and Investment (DETI) and the NIAER carry joint responsibility for security of supply. With the introduction of market liberalisation in July 1999 as a result of the IME Directive (96/92/EC) the market is expected to provide adequate generation capacity. It is the intention that this Statement would identify and highlight risks to security of supply if the market fails to deliver adequate generation capacity.

Since market liberalisation in July 1999 NIE has continued to monitor the generation capacity situation and highlighted issues to the Northern Ireland Authority for Energy Regulation (NIAER) and their predecessor. With the Authority's approval NIE has put in place short term arrangements to cover known capacity shortfalls.

2. GENERATED PEAK DEMAND FORECAST

2.1 Forecast Demand Data

The Transmission & Distribution system maximum demand data is based on totalised data from power stations, interconnectors, renewable generation etc. The forecast does not include the demand that was suppressed by customer private generation. (An estimate of customer private generation is made for the year ahead to assist in generation maintenance outage planning.)

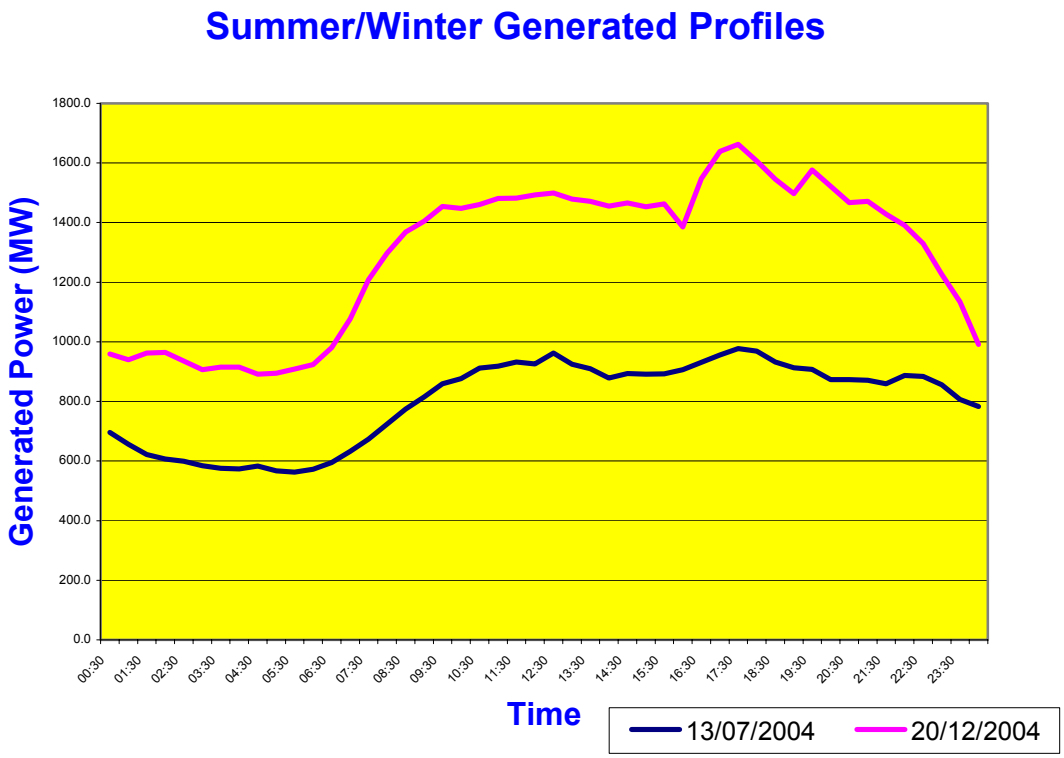
Temperature has been found to have the greatest effect on demand compared with other meteorological factors. Temperature correction in the form of average cold spell (ACS) analysis is necessary to remove the demand variation caused by temperature, thus enabling the underlying demand growth rate to be determined more accurately. This analysis involves the determination of the relationship between demand, temperature and the day of the week. Analysis of 25 years of historic temperature data establishes the temperature, which reflects "averagely cold conditions". The actual recorded generated peak demand is then adjusted to reflect ACS conditions. Historic ACS corrected demands are subjected to statistical analysis to calculate correlated trend lines and growth rate predictions.

2.2 System Maximum Demand

The actual 2004/2005 Northern Ireland system peak demand was 1663MW and occurred on Monday 20th December 2004 at 17:20 hours.

The Generated profiles (including centrally despatched generator output, interconnector energy flows and embedded generation that is exported onto the network) for Monday 20th December 2004 and 13 July 2004 are shown in Figure 1. The graphs give an indication of the profile and volume of demand for winter peak demand and the summer trough. On the 20th December 2004 the network utilisation is at a maximum around 17:30 hours; this maximum demand is as a result of coincidental usage patterns, for example domestic cooking load, lighting load etc. The graph does not include the demand that was suppressed by customer private generation (eg. operation of diesel generators), this is estimated at 130MW. The graphs represent the equivalent power generated to meet the total NI customer demand and power station auxiliary equipment demand.

Figure 1



2.3 System Maximum Demand Forecast

Manufacturing output in NI declined in the second half of 2004, in line with weaker output in GB. The economic fundamentals however remain strong as employment, household incomes and consumer spending continues to rise. A new investment strategy has been launched, promising up to £16bn in spending over the next 15 years. With this in mind the overall NI economy is expected to expand despite the decline in the manufacturing sector, driven by rising public expenditure and increased private sector activity.

The forecast (Figure 2) used in this statement is based on data up to and including the 2004/05 winter period and is corrected to ACS conditions.

	ACS Forecast MW	Private Gen. Estimate MW	Excluding Private Gen. MW
2005/06	1834	130	1704
2006/07	1861	130	1731
2007/08	1890	130	1760
2008/09	1918	130	1788
2009/10	1948	130	1818
2010/11	1977	130	1847
2011/12	2008	130	1878

Figure 2

The overall network energy growth (kWhr) predictions have reduced from growth rates in excess of 2% in the late nineties to a current predictions of circa 1.5%. NIE demand predictions take into consideration exogenous factors such as the impact of Natural Gas and Energy Efficiency Initiatives. It should also be noted that the growth in peak demand has been consistently less than the growth in overall energy sales over the last ten years however, it is expected that this trend has exhausted the load factor improvements and both peak demand and overall energy sales will grow at similar rates in future. The current SONI temperature corrected peak demand growth forecast is 1.5%.

3. GENERATION CAPACITY

3.1 Generation Capacity Contracted to NIE

Plant contracted to NIE either under pre-vesting contracts or contracts negotiated thereafter totals to a maximum of 1532MW measured as output capacity at generator terminals. All of this capacity is assumed to remain committed for the duration of the period covered by this statement.

Generating Plant Capacities

Station		Fuel Used	Contracted Capacity MW (at peak)
Kilroot	Unit 1	HFO/Coal	260/220
	Unit 2	HFO/Coal	260/220
	GT 1	Gas Oil	29
	GT 2	Gas Oil	29
B'ford	Unit 4 [Note 1]	Gas/HFO	180[Note 1]
	Unit 5 [Note 1]	Gas/HFO	0 [Note 1]
	Unit 6 [Note 1]	Gas/HFO	[Note 1]
	GT 1	Gas Oil	58
	GT 2	Gas Oil	58
	CCGT A	Gas/Gas oil	250
	CCGT B	Gas/Gas oil	250
	CCGT D	Gas/Gas oil	100
C'Keer	GT 8	Gas Oil	58
		TOTAL	**1532**

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[1]. These capacity reductions are ignored for generation security purposes.

[Note 1] During 2002/3, 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 capacity is not counted in the calculation of capacity available for NI as it may be fully committed to RoI.

3.2 Renewable Generation

3.2.1 Non Fossil Fuel Obligation (NFFO) Capacity

Under the Non Fossil Fuel Obligation (NFFO), NIE signed contracts for approximately 15 MW DNC (Declared Net Capacity) of Non Fossil Fuel Plant on 1 April 1994 and 16 MW DNC on 4 September 1996. The commissioned schemes are shown in the table below and these contracts will start to expire on 31st March 2009. However, for the purposes of this statement, it is assumed all the plant will remain available until at least 2012.

Scheme Name	Technology	Capacity	
		Gen kW	DNC kW
NFFO1			
Rigged Hill	Wind	5000	2142
Corkey	Wind	5000	2142
Slieve Rushen	Wind	5000	2086
Elliott's Hill	Wind	5000	2142
Bessy Bell	Wind	5000	2098
Owenreagh	Wind	5000	2054
Harperstown	Hydro	250	250
Benburb	Hydro	75	75
Carrickness	Hydro	155	155
Park Mills	Hydro	30	30
Randalstown	Hydro	500	500
Blackwater	Hydro	100	100
Sion Mills	Hydro	780	780
Oakland's WTW	Hydro	49	49
Silent Valley	Hydro	435	435
Total NFFO1		32374	15038
NFFO2			
Lendrum's Bridge	Wind	5000	2141
Slievenahanaghan	Wind	1000	426
Blackwater Museum	Biomass	204	204
Brook Hall Estate	Biomass	100	100
Benburb Small Hydro	Hydro	75	75
Total NFFO2		6379	2946

3.2.2 Additional Renewable Generation

The following independent wind generation schemes have been connected to the NIE grid.

Scheme Name	Technology	Maximum Capacity (MW)	Date Commissioned
Altahullion	Wind	26	April 2003
Lendrums Bridge	Wind	8.2	October 2002
Snugborough	Wind	13.5	October 2003
Tappaghan	Wind	19.5	December 2004
Total		**67.2**	

3.3 Capacity Changes over the next 7 Years

In 2003, the Department for Enterprise, Trade and Investment (DETI) announced its intention to place a renewable obligation on suppliers and to back this with a system of renewable certificates tradable throughout the UK (NI ROC). The Northern Ireland Renewables Obligation came into effect on 1 April 2005. The obligation requires suppliers to deliver a percentage of energy from renewable sources. This implies 250MW of installed wind power capacity by 2009/10. Because NI ROCs can be sold in the much larger market in G.B., production of renewable energy in excess of the Northern Ireland Obligation is incentivised. Examination of connection enquiries and discussions with DOE would indicate that the 2005/06 capacity of 150MW could be progressively increased to 500MW by 2010/11. Management of this amount of distributed and variable generation will prove a challenge. There are problems to solve in real time energy management and network capacity if this level of penetration is to be realised. Beyond about 200MW there will be a need to consider curtailment of the total wind farm output at times of low system demand.

The Obligation on suppliers for 2012 is set in NI as 6.3%, measured by energy. Government has also set a target of 12% for 2012 measured by energy. This is set to inform planners and other interested parties of the envisaged potential of NI to contribute to UK carbon reduction targets.

Capacity Available to meet N. Ireland Demand

Year	Capacity Changes (MW)	Total Plant (MW)
05-06	-2×60 (C'K) [1] +414 (C'K)[1] + 44MW (renewables)	2546
06-07	+ 110MW (renewables)	2656
07-08	+ 100MW (renewables)	2756
08-09	+ 100MW (renewables)	2856
09-10	+ 40MW (renewables)	2896
10-11	+ 0MW (renewables)	2896
11-12	+ 0MW (renewables)	2896

3.4 Interconnection

Moyle

In 2002 a high voltage direct current (HVDC) link between Scotland and NI was commissioned. The installed capacity of the link is 500MW but the transfer capability is curtailed by certain network limitations on both sides. The available transfer capacity is therefore 400MW except in emergency conditions when it can be increased to 450MW. 125MW of capacity has been retained by NIE PPB until late 2007. The remaining interconnector capacity is auctioned for up to three years ahead by the transmission system operator (TSO) in NI. Some of this capacity is purchased by market participants to facilitate transit energy flows to supply the RoI market. The capacity can, in emergency situations, be used solely to meet the NI peak demand. It is for this reason that this capacity assessment assumes the capacity of the Moyle Interconnector as 450MW. This is consistent with the methodology adopted by ESB National Grid for the treatment of market trades across the interconnector between NI and RoI.

The Balancing & Services Agreement between SONI and NGT facilitates energy purchases including emergency assistance up to the 450MW capacity of the interconnector. The availability level attributed to the Moyle interconnector includes an assumption that there would be capacity available in a GB system with circa 70TW of installed generation capacity. It should also be noted that there have been occasions when energy has not been available during a capacity shortfall either for balancing trades or emergency assistance.

North – South

[1] A new CCGT plant was commissioned at Coolkeeragh on 1 April 2005 and is not subject to a Power Purchase Agreement with NIE. The 2 x 60MW sets were withdrawn from service on 31 March 2005.

The available export transfer capacity to RoI is 330MW by synchronous interconnection. Some trades from Scotland on the Moyle High Voltage Direct Current (HVDC) Interconnector pass through the NI transmission system to RoI and in addition a percentage of the output of the Coolkeeragh CCGT is exported to RoI. In the event of a major loss of NI generation the energy flows on the interconnector to the RoI may be pulled back to zero, such that if load shedding is required the importing utility must take appropriate action to reduce demand. This methodology is adopted consistently by both SONI and ESBNG, thus avoiding modeling inconsistencies.

The RoI generation adequacy is low at present and it is not anticipated that at peak demand periods imports to NI will be available, however between 80-170MW of import interconnector capacity may be available during lighter demand periods if generation capacity is available in RoI.

4. GENERATION SECURITY STANDARD

The generation security planning standard is based on a disconnection rate of 70 days in 100 years and a voltage and frequency reduction rate of 140 days in 100 years at times of annual system peak demands. This statement uses this standard.

The method of calculation of the risk of failure for each year is a comparison of the probabilities of capacity being available with the probabilities of peak system demands, as follows: -

- The projected availabilities at peak periods of each item of plant are built into an available capacity probability distribution for each year.

- The top 50 days of the year when demand on the system is highest are considered to be the times of risk and a distribution of demands over those days is constructed, with the restricted ACS peak as the highest. No allowance is made for errors in demand forecasting.

- A failure occurs when demand is greater than available plant capacity. The probability of this occurring is the disconnection rate for that year.

- With increasing generating unit size the methodology adopted does not fully reflect the potential for capacity shortfalls at other periods outside the 50 peak demand periods.

The methodology employed in RoI is based on Loss of Load Expectation (LOLE). Work has commenced to compare the results from both methodologies. The objective is to agree an all-island

methodology and to move towards the provision of an all-island generation adequacy report.

4.1 Projected Availabilities at Peak Periods

Two projections of the availability of generating plant and interconnector capacity are considered.

- **A higher availability projection** - these figures are based on the average peak availability achieved by the generating units over the last 10 years and the projection assumes that this high level of availability will continue to be achieved.

- **A lower availability projection** - these figures are given to show the effect on generation security of a fall back to a poorer standard of plant availability.

Projected plant availabilities and capacities during peak periods are shown for each year up to 2011/12 in Table 1.

Table 1
Projected Generator Availabilities & Capacities at Peak Periods

		Availability at Peak Periods		Generation Capacity						
				2005/6	2006/7	2007/8	2008/9	2009/10	2010/11	2011/12
Site	**Unit**	**High**	**Low**	**MW**	**MW**	**MW**	**MW**	**MW**	**MW**	**MW**
Ballylumford	G4	0.97	0.95	180	180	180	180	180	180	180
	GT1	0.97	0.95	58	58	58	58	58	58	58
	GT2	0.97	0.95	58	58	58	58	58	58	58
	CCGT A	0.97	0.95	250	250	250	250	250	250	250
	CCGT B	0.97	0.95	250	250	250	250	250	250	250
	CCGT D	0.96	0.95	100	100	100	100	100	100	100
Kilroot	G1	0.98	0.95	260	260	260	260	260	260	260
	G2	0.98	0.95	260	260	260	260	260	260	260
	GT1	0.98	0.95	29	29	29	29	29	29	29
	GT2	0.98	0.95	29	29	29	29	29	29	29
Coolkeeragh	G6	0.97	0.90							
	G7	0.97	0.90							
	GT8	0.97	0.95	58	58	58	58	58	58	58
	CCGT	0.97	0.95	414	414	414	414	414	414	414
Moyle	DC link	0.99	0.98	450	450	450	450	450	450	450
Renewables	*Note 1*	0.99	0.00	150	260	360	460	500	500	500
		Total Plant MW		**2546**	**2656**	**2756**	**2856**	**2896**	**2896**	**2896**

Notes
1. Renewable generation is assigned a capacity credit of 20% with 0.99 availability for the High Availability scenario, and a zero capacity credit for the Low Availability scenario. (Derived from analysis of historic windfarm output data.
2. The availability figures for Ballylumford G4 take account of the presence of unit G5 which can be used as a replacement if required.

4.2 Peak (Demand) Which Can Be Met - PWCBM

The results of the assessment of particular plant totals against the generation security standard are shown in terms of peak demand which can be met by such plant capacity.

The analysis considers the generation capacity available and utilises the generation availability factors to determine the level of demand that could be met whilst complying with the generation security standard.

The 'peak which can be met' (PWCBM) is calculated with results as follows.

Peak which can be Met (PWCBM) against Security Standard
Using **Higher** Availability Projection

Year	Total Plant MW	PWCBM MW
2005/6	2546	2036
2006/7	2656	2059
2007/8	2756	2079
2008/9	2856	2099
2009/10	2896	2107
2010/11	2896	2107
2011/12	2896	2107

Peak which can be Met (PWCBM) against Security Standard
Using **Lower** Availability Projection

Year	Total Plant MW	PWCBM MW
2005/6	2546	1826
2006/7	2656	1826
2007/8	2756	1826
2008/9	2856	1826
2009/10	2896	1826
2010/11	2896	1826
2011/12	2896	1826

4.3 Deterministic assessment of generation capacity

The present methodology does not adequately represent the potential magnitude of load shedding that may occur when coincidental plant outages occur. The recent commissioning of the 414MW CCGT at Coolkeeragh and the 450MW infeed at Moyle result in high individual generation unit capacity to total peak demand ratios.

Table 2 illustrates the capacity shortfall (potential load shedding) for the loss of a generating unit in combination with the loss of the 450MW Moyle interconnector at peak demand time. It assumes no wind and zero transfer on the North – South interconnector

Table 2 Deterministic assessment of generation capacity

Generating Station station		Moyle	CPS	KPS	KPS	BPS	BPS	BPS	BPS	BPS	BPS	CPS	KPS	KPS	NI
Generating Unit		DC link	CCGT	G1	G2	CCGT A	CCGT B	G4	CCGT D	GT1	GT2	GT8	GT1	GT2	Total Capacity
Generating Capacity (MW)		450	414	260	260	250	250	180	100	58	58	58	29	29	2396
% of Total NI Capacity		19%	17%	11%	11%	10%	10%	8%	4%	2%	2%	2%	1%	1%	
Year	*Peak Forecast*														
2005/6	1704		-172	-18	-18	-8	-8	62	142	184	184	184	213	213	
2006/7	1731		-199	-45	-45	-35	-35	35	115	157	157	157	186	186	
2007/8	1760		-228	-74	-74	-64	-64	6	86	128	128	128	157	157	
2008/9	1788		-256	-102	-102	-92	-92	-22	58	100	100	100	129	129	
2009/10	1818		-286	-132	-132	-122	-122	-52	28	70	70	70	99	99	
2010/11	1847		-315	-161	-161	-151	-151	-81	-1	41	41	41	70	70	
2011/12	1878		-346	-192	-192	-182	-182	-112	-32	10	10	10	39	39	

notes

1) If an outage of Moyle is accompanied by a further generator trip, the ability to meet the peak demand is calculated. Potential load shedding is negative and highlighted in red.

2) The calculations assume no wind generation and zero S - N transfer

5. NEW CAPACITY REQUIREMENTS

On the basis of projected demands and projected plant availabilities at peak periods, and assuming that any new arrangements for generation security are similar to the existing security standard, the over and under achievements of the security standard can be calculated (see Table 1).

Using **Higher** Availability Projection

Year	Total Plant MW	PWCBM MW	Projected Peak Demand MW	Generation Surplus/Deficit	Capacity Required MW
2005/6	2546	2036	1704	332	0
2006/7	2656	2059	1731	328	0
2007/8	2756	2079	1760	319	0
2008/9	2856	2099	1788	311	0
2009/10	2896	2107	1818	289	0
2010/11	2896	2107	1847	260	0
2011/12	2896	2107	1878	229	0

Peak which can be Met (PWCBM) against Security Standard
Using **Lower** Availability Projection

Year	Total Plant MW	PWCBM MW	Projected Peak Demand MW	Generation Surplus/Deficit	Capacity Required MW
2005/6	2546	1826	1704	122	0
2006/7	2656	1826	1731	95	0
2007/8	2756	1826	1760	66	0
2008/9	2856	1826	1788	38	0
2009/10	2896	1826	1818	8	0
2010/11	2896	1826	1847	-21	21
2011/12	2896	1826	1878	-52	52

Notes

1. This analysis assumes a zero MW transfer to/from the ESB system.
2. A possible future increase in the Moyle DC link capacity from 450MW to 500MW would yield an increase in PWCBM of 33-42MW.
3. Projected Peak Demand figures represent the Average Cold Spell (ACS) forecast generation less an estimated 130MW of private generation.

Under the high availability scenario the generation capacity standard is met in each year. There is a modest deficit in 2010/11 and 2011/12 when the standard is based on the lower level of availability.

Operating at the generation security standard implies that load shedding can be anticipated to occur every 1.43 years.

The ratio of generating unit sizes to peak demand is now higher than previously. There are also a lower number of generating units on the Northern Ireland System. This increases the potential for loss of supply to customers and tighter margins during planned generation outages. Any degradation of the high historic levels of availability will impact on security of supply

6. FUTURE DEVELOPMENTS

6.1 Coolkeeragh CCGT

A 414MW Combined Cycle Gas Turbine (CCGT) was commissioned at Coolkeeragh on 1 April 2005. This plant is included in the calculation of PWCBM in the preceding sections of this document.

6.2 Interconnection with the Republic of Ireland.

The interconnection with the Republic of Ireland was re-commissioned in the spring of 1995. It has been used for short-term operational benefits and commercial trading.

The North-South available transfer capacity for the coming year is 330MW plus a transmission reliability margin. NIE system stability limitations curtail transfer capacity.

The South-North transfer capacity for daytime commercial trading is 80-120MW and at nighttime 170MW. Trading in a South-North direction has been enhanced by the introduction of superposition.

At present the RoI has a shortfall in generation capacity and therefore there is limited trading in the South-North direction.

NI and ROI Government ministers support further interconnection and NIAER, CER and the utilities are actively pursuing this as a project.

6.3 Opportunities for New Generation

<u>All-Ireland Perspective</u>

It is not sensible to deal with NI alone when discussing the opportunities for new generation. The reader should consider the plans for market evolution in both jurisdictions and refer to the RoI Generation Adequacy Statement produced by ESB National Grid (ESBNG).

Interconnection

Transmission system limitations constrain transfers into and out of NI despite interconnection between NI & RoI and between NI & Scotland. Studies part funded by EU are being undertaken between NIE and ESBNG to determine the most feasible alternative for increased interconnection capacity in the North-South and South-North directions. No schemes are at present being considered to increase the tradable capacity of the Moyle DC link from 400MW to 500MW. In NI this would require an increase in capacity of transmission circuits operating at 275kV and some additional reactive support. By operating the Moyle at 500MW it would become the largest source feeding into the all-island system. To cover the contingency of the sudden loss of the Moyle link at 500MW would require the all-island system to carry additional spinning reserve.

Location of Generation in NI

NIE's 2004 Transmission Seven Year Statement deals with the issues of generation and demand location.