

# **NI WIND QUARTERLY REPORT FEB 2006**

## **Strategic Review**

### **Overview**

In December 2004, we started to advise market players that we were unable to accept any more unconstrained capacity of wind farms in the North West region of our network. The issue was a backbone system constraint (see below). Since then we have managed to negotiate an improved operation of emergency network protection at Coolkeeragh Power station. This scheme operates after a defined very severe network event. We are now able to allow a further circa 75MW of unconstrained capacity to be connected. In 2006, network developments in the region will allow a further 50MW. These figures are average and this report shows how they vary with location of connection.

Later in the Report we indicate that we believe that a low level of summer constraint should be acceptable to wind farm power station operators. This should allow reasonable progress in connections to be made until network developments are completed in 2006.

### **Information on Wind Penetration**

NIE updates this statement on a regular basis. This allows developers to understand the position. For each issue (see below) we update the installed, committed etc columns and we note the progress on strategic issues.

### **Process and General Issues which Limit Wind Power Penetration**

There are a number of issues which limit the amount of wind power that NIE can safely accept. The significant issues are:

- Variability and energy services uncertainty
- Technical uncertainty (voltage management, fault ride through, reserve and so on)
- Local network issues

At present, NIE's network has a total of 12 connected wind farms with a total installed capacity of 120.1MW. We have connected a new CCGT station in the NW, the total capacity of which is circa 472MW (Coolkeeragh). Other enquiries for wind powered stations amount to some 1400MW (incl off-shore). Most of this new generation is expected in the north or west of our area of supply, away from electrically strong networks. We have also been asked to connect to NIE's network, generation just inside RoI.

Clearly, taken together this amount of wind is likely to create unmanageable variability. Nor are we clear that with reduced system inertia caused by certain types of wind farm power stations, the technical issues could be managed, so some level of constraint is likely to be imposed even before we consider local network capacity issues. We held a meeting in May 2004 with

our Regulator and interested parties to discuss the most effective and equitable rules to be applied.

As a result we now apply a rule that only projects which have obtained Planning Permission can be offered a Connection Agreement. This is to prevent unsuccessful projects retaining capacity at nodes. This concept seems to be supported by the industry and accepted by our Regulator.

To understand the main issues we have constructed three summer minimum cases for the year 2006. The existing wind farms and projects under offer have been included. Summer minimum is the most arduous condition for two reasons:

- Circuit ratings are lower in summer due to higher ambient temperature,
- The load present at local nodes is much less on summer evenings, therefore the circuits have a higher export flow.

### **33kV Capacity Review**

The following table shows the level of interest from developers on the basis of requested capacity at each 33kV node.

<b>BSP</b>	<b>Existing Wind Generation (MW)</b>	<b>Committed Wind Generation Projects (MW)</b>	<b>Additional Enquiries (MW)</b>	<b>Total Potential Generation (MW)</b>
Belfast	0.0		45.00	45.00
Ballymena	6.0		1.80	7.80
Coleraine	5.0		60.00	65.00
Coolkeeragh	0.0		81.00	81.00
Dungannon	0.0		46.00	46.00
Eden	0.0		14.00	14.00
Enniskillen	35.4		100.00	135.40
Larne	5.0	11.5	19.25	35.75
Limavady	26.0		21.00	47.00
Lisaghmore	0.0		13.00	13.00
Omagh	37.7	11.7	150.00	199.40
Strabane	5.0	23.1	121.80	149.90
<b>TOTALS</b>	<b>120.1</b>	<b>46.3</b>	<b>672.85</b>	<b>839.25</b>

The above generation is reflected into the 110kV system and there are some connections which are requested at this level as follows:-

BSP	Total Potential Generation @ 33kV (MW)	Enquiries requiring connection @ 110kV (MW)	Total Potential Wind Generation (MW)	Comments
Belfast	45.00		45.00	
Ballymena	7.80		7.80	
Coleraine	65.00	200.00	265.00	
Coolkeeragh	81.00		81.00	
Dungannon	46.00		46.00	
Eden	14.00		14.00	
Enniskillen	135.40	60.00	195.40	
Larne	35.75		35.75	
Limavady	47.00	85.00	132.00	
Lisaghmore	13.00		13.00	
Omagh	199.40	231.00	430.40	
Strabane	149.90		149.90	
<b>TOTALS</b>	<b>839.25</b>	<b>576.00</b>	<b>1415.25</b>	

### **Backbone Network Issues**

Coolkeeragh is a generation saturated node, we have negotiated that the CCGT generator is returned to an output of 160MW over a period of 100 seconds, on the worst case circuit outage – Coolkeeragh-Magherafelt 275kV double circuit. Since temporary overloading of the network over this period would be acceptable, the network connection capacity has been calculated with the CCGT at 160MW.

In assessing wind potential we have assumed that the OCGT (GT8) at Coolkeeragh will not be operating at summer minimum along with both elements of the CCGT.

There is more scope to accept wind power higher up the loading curve as local loads will reduce export.

The following Table 1 shows the results of transmission network studies, which we have carried out to date. These results are based on the existing network and do not reflect the impact of approved network reinforcements.

Table 1: Existing available nodal capacity

Bulk Supply Point	Availability of unconstrained wind generation	Constraint
Strabane	66MW / 35MW*	Kells-Coleraine Thermal / BSP Transformers*
Omagh	101MW / 40MW	Kells-Coleraine Thermal / BSP Transformers
Enniskillen	101MW / 73MW	Kells-Coleraine Thermal / BSP Transformers
Coolkeeragh	56MW / 112MW	Kells-Coleraine Thermal / BSP Transformers
Limavady	45MW / 27MW	Kells-Coleraine Thermal / BSP Transformers
Coleraine/ Loguestown	41MW / 66MW	Kells-Coleraine Thermal / BSP Transformers
Dungannon	105MW	Dungannon-Drumnakelly 1 Thermal

\* The first value is caused by the first constraint and the second value is caused by the second constraint. Please note that it should be possible to remove the second constraint with the use of automatic local control schemes.

Our studies are based on Summer 2006.

Table 2 shows the impact of approved reinforcements which are planned for completion by Summer 2006.

Table 2: Available nodal capacity following completion of approved works

BSP	Availability of unconstrained wind generation	Constraint
Strabane	107MW / 35MW	Omagh-Strabane Thermal / BSP Transformers
Omagh	107MW / 40MW	D'gannon-Omagh Thermal / BSP Transformers
Enniskillen	96MW / 73MW	D'gannon-Omagh Thermal / BSP Transformers
Coolkeeragh	116MW / 112MW	Kells-Coleraine Thermal / BSP Transformers
Limavady	61MW / 27MW	Lim-Coleraine Thermal / BSP Transformers
Coleraine/ Loguestown	85MW / 66MW	Kells-Coleraine Thermal / BSP Transformers
Dungannon	95MW	Dungannon-Drumnakelly 1 Thermal

The nodes around Coolkeeragh, Strabane, Omagh, Limavady, Coleraine and Loguestown have linked network capacity and increasing generation at one node affects the connection capacity at all nodes. Table 3 shows approximately the effect on capacity of installing generation at any node.

Table 3: Participation factor matrix

New Gen / Effect on Capacity	Nodes						
	Cole	Ennisk	Omagh	Strabane	Lima	Coolk	Dungannon
Coleraine		-2.33	-2.33	-1.51	-1.05	-1.29	-0.54
Enniskillen	-0.37		-0.92	-0.60	-0.41	-0.51	-0.89
Omagh	-0.37	-0.92		-0.59	-0.41	-0.50	-0.88
Strabane	-0.56	-1.38	-1.38		-0.62	-0.76	-0.74
Limavady	-0.81	-2.02	-2.02	-1.31		-1.11	-0.58
Coolkeeragh	-0.65	-1.61	-1.61	-1.05	-0.72		-0.67
Dungannon	-0.16	-0.39	-0.39	-0.25	-0.17	-0.21	

The value of each cell represents the connection capacity reduction at the node identified by the column heading for each MW connected at the node identified in column 1.

The participation factors shown above are calculated for the loss of the Coolkeeragh-Magherafelt 275kV double circuit. This analysis is for guidance purposes only and the effect of each connection application on the network capacity will be individually assessed.

### **Example**

The Participation Factor Matrix shows the interaction between network nodes.

The connection of 1MW of generation at Strabane results in a corresponding **reduction** of unconstrained generation at each of the following nodes in the table.

	Cole	Ennisk	Omagh	Strabane	Lima	Coolk	D'gannon
Strabane	0.54MW	1.33 MW	1.33 MW		0.60MW	0.74MW	3.06MW

### **Constraint**

We carried out studies in Summer 2005, which support a view that if the output of wind farms was constrained to 93% of installed capacity during summer periods, this would not materially effect their commercial performance. This addressed an inaccuracy in our Summer 2004 report caused by wind farm transducers malfunctioning. In our next Quarterly Report we will attempt to indicate the impact which this would have on network issues.

### **Diversity**

The same report demonstrates that wind farm power stations in Northern Ireland have highly correlated outputs when long periods e.g. 1 day and above are considered, but that there is diversity of output when viewed over short time periods...say one hour or less.

### **Study progress**

We have sought permission from wind farm operators to carry out more studies in support of our constraint and diversity conclusions above and we will shortly report on that work.

### **Grid Code Changes**

We have received consensus on our Grid Code changes for wind farm power stations and anticipate Regulatory approval before the end of February 2006. There remains some unfinished work around sub-synchronous harmonics, islanding protection and inertia. In the mean time, in conjunction with the system operator (SONI) we have been considering the other sections of the Grid Code, some of which have terms or conditions not suited to wind farms, e.g. the Scheduling and Dispatch Code. We intend to include these amendments in the Single Electricity Market change for 2007 and will consult on any changes needed. We do not envisage these changes to require the same degree of manufacturer participation as those related to plant capability.

### **Compliance with Grid Code**

We have recently developed a document that sets out how compliance is to be demonstrated for Wind Farm Power Stations. We realise that all parties will be in a learning position and that mutual good will is required in the early stages.

### **Connection Arrangements**

In anticipation of a day when constraint on network or variability management grounds will be a real issue, we have been considering the process of agreeing connection of variable generation sources. We intend to propose to our Regulator that relevant parties are consulted on this. In this way, we hope to establish transparent arrangements that the market players agree are equitable. In the meantime we have prepared a generic form of a connection agreement for wind farm power stations.