Application Form for Connection of

Wind Generation Facilities

to the Transmission System

INTRODUCTION

This application form (version 1.1) outlines the information EirGrid requires to progress an application for connection to the Transmission System. EirGrid recommends that the applicant read "Process for Connection" published on our website, www.eirgrid.com. This document describes the connection offer process and sets out the associated application processing fees. The website has links to other relevant documents such as the Grid Code. It should be noted that it is the applicant's responsibility to comply with the technical, design and operational standards detailed in the Grid Code.

Please note for the purpose of this application form TSO should be interpreted as: the holder of the license to operate Ireland's Transmission System (EirGrid).

Please note that this application form deals with HV connections only ($\geq$ 110 kV) and that if an MV ($<$ 110 kV) supply is required the applicant should contact ESB Networks:
Tel: +353 850 372 757, www.esb.com

EirGrid reserves the right to request additional data if necessary and the applicant should provide such information promptly during and post the offer process.

It is EirGrid's responsibility to determine the transmission connection method; if the applicant has a specific request this will be considered and examined in the process. The selected method will be based on the overall least cost technically acceptable solution unless the Applicant requests otherwise or EirGrid requires an alternative method for system reasons.

Definitions of terms used in this form can be found in the Glossary of the Grid Code.

The following information will be disclosed in the Interactions list found on www.eirgrid.com once the application is deemed fully complete by EirGrid.

- Applicant details (contact name, email address, telephone number).
- Application complete date.
- Status of application.
- Grid co-ordinates of electrical connection point.
- Capacity of Project (MW).
- Interacting group where applicable (with all of the above details available separately for each member of the group).

When the application form is completed please send the form to:

EirGrid
New Applications, Codes and Agreements
27 Lower Fitzwilliam Street
Dublin 2
Ireland

If any queries arise please do not hesitate to contact our Customer Relations Team.

Tel: +353 1 702 6642
Fax: +353 1 661 5375
email: info@eirgrid.com

DETAILS OF APPLICANT

1. **Full name of the applicant(s)**

2. **Address of the applicant(s) or in the case of a corporate body, the registered address and company registration number**

Company ref. no. (if applicable)

3. **Telephone Number**

4. **Telefax Number**

5. **Contact Person(s)**

6. **Email Address**

7. **Contact Address (if different to above)**

8. **Please nominate a preferred name for this facility.**
The TSO will take this preferred name into consideration when determining the facilities station name but reserves the right to change it in order to avoid any potential for confusion with other projects or stations.

GENERAL DETAILS

9. **It should be noted that it is the applicants responsibility to comply with the technical, design and operational standards detailed in the Grid Code**

Noted

10. **Has the Applicant signed a confidentiality agreement with TSO?** **Yes** **No**
If no, two copies have to be submitted with application form.
Confidentiality agreement templates can be found on our website, www.eirgrid.com.

11. **Has the Applicant previously had a pre-feasibility study regarding this facility completed by TSO?** **Yes** **No**
If yes, please specify name and the date of issue of the Pre-feasibility study(s).

Study 1:

(D/M/Y)

Study 2:

(D/M/Y)

MAPS AND DIAGRAMS

12. **Please provide a 1:50,000 "Discovery Series" Ordnance Survey map, with the location of the facility clearly marked.** The electrical connection point must be clearly marked with an "X".

Name of OS map attachment

Grid co-ordinates of the electrical connection point of your site (In appendix A an example is shown of how to correctly specify the grid co-ordinates):

Easting

Northing

13. **Please provide a site plan in an appropriate scale. This site plan should indicate:**

- the proposed location of the connection point
- generators
- transformers
- site buildings
- meteorological masts etc.

Note that the connection point is normally at the HV bushings of the grid connected transformer. Space for the transmission compound will have to be clearly marked on the site plan. The exact size of the compound will depend on the connection method defined in the connection offer. Site plan is to be submitted in both hard and soft copy.

Name of site plan attachment (soft copy)

Name of site plan attachment (hard copy)

14. **Please provide an electrical Single Line Diagram (SLD) of the proposed facility detailing all significant items of plant and their values including the following as applicable:**

- Relevant voltage levels
- Interlocking
- Earthing and synchronising arrangements
- Relay types
- CT/VT ratios
- Generator transformer(s)
- Power factor correction devices
- Location of alternative connection for house load (if applicable)
- Grid connected transformer(s)

The SLD is to be submitted in both hard copy and soft copy.

Name of the SLD attachment (soft copy)

Name of the SLD attachment (hard copy)

TECHNICAL DETAILS REQUIRED

GENERAL DATA

15. **Target Connection Date (this date will be used for connection assessment)**

(D/M/Y)

16. **Projected period from Target Connection Date to Operational Date: (x months)**

TECHNICAL DETAILS REQUIRED

GENERAL DATA – CONTINUED

17. **Maximum Export Capacity (MEC) required**
This is the amount of exporting transmission capacity that will be provided for in the connection offer.

MW

18. **State number of connecting circuits to the Transmission System (eg. one, two etc.), the applicant requires for technical and/or security reasons.**

19. **Total number of generation units**

WIND TURBINE GENERATOR (WTG)

	Type 1	Type 2	Type 3
20. Manufacturer of wind turbine			
21. Model and type of above turbine			
22. Number of generators of type			
23. Rated power output of each turbine (MW)			
24. Wind turbine generator rated MVA			
25. Wind turbine generator voltage (kV)			

26. **Please provide a power curve approved by the WTG manufacturer and specific to the WTG(s) specified above** Submitted

Name of attachment

27. **Magnitude and duration of inrush/starting current (per turbine)** A (ampere) milliseconds

28. **Please provide a power quality test report in accordance with IEC (61400-21:2001).** Submitted

Name of attachment

29. **Please note if the total Installed Capacity of the wind farm is greater than the MEC then EirGrid may require further information detailing how this MEC will not be exceeded.** Noted

WIND TURBINE GENERATOR (WTG) TRANSFORMER

All impedances in % on transformer MVA base

	Type 1	Type 2	Type 3
30. Rating of WTG transformer (MVA)			
31. Temperature above rating is based on (˚C)			
32. WTG transformer voltage ratio MV/LV (kV)			
33. WTG transformer positive sequence resistance (R_1%)			
34. WTG transformer positive sequence reactance (X_1%)			
35. WTG transformer zero sequence resistance (R_0%)			
36. WTG transformer zero sequence reactance (X_0%)			
37. WTG transformer vector group			

APPLICATION FORM – WIND GENERATION

TECHNICAL DETAILS REQUIRED

WIND FARM SITE

38. **Please state the power factor ranges of the generators at the specified active power percentages and then specify the equivalent Mvar capability.**

		10%		50%		100%	
		Ind.	Cap.	Ind.	Cap.	Ind.	Cap.
Type 1	Power Factor of Generators						
	Equivalent Mvar						
Type 2	Power Factor of Generators						
	Equivalent Mvar						
Type 3	Power Factor of Generators						
	Equivalent Mvar						

39. **Number of inductive devices**

Indicate for each device the inductive Mvar capability. If the device has more than one stage please indicate the number of stages and the Mvar capability switched in each stage.

Mvar in steps

Mvar in steps

40. **Number of capacitive devices**

Indicate for each device the capacitive Mvar capability. If the device has more than one stage please indicate the number of stages and the Mvar capability switched in each stage.

Mvar in steps

Mvar in steps

41. **Please indicate the inductive Mvar contribution of the internal wind farm structure** (ie. 20 kV cable)

Mvar

42. **Please provide a reactive capability curve for the wind farm site as measured at the lower voltage side of the grid connected transformer.** The capability curve should specify Mvar vs MW for the entire range of MW output. The curve should be consistent with the answers given in the questions above. Please note that the wind farm must be in compliance with Grid Code WFPS.1.6.3.

Name of the attachment

43. **Provide details of start-up regime.** (Number of simultaneous starts, use of control system etc.)

TECHNICAL DETAILS REQUIRED

WIND FARM SITE – CONTINUED

44. **Please provide test results demonstrating fault ride through capability in accordance with Figure WFPS1.1 in the Wind Grid Code ref: WFPS1.4.1.**
If this can not be achieved, please provide test results demonstrating the achievable fault ride through capability.

Name of the attachment

45. **State the longest expected time to return to 90% of pre-fault power output following any voltage dips within the voltage vs time characteristic of figure WFPS1.1 in the Grid Code ref: WFPS1.4.1.**

INTERNAL WIND FARM NETWORK STRUCTURE AND CORRESPONDING DATA

46. **Please describe how the wind farms internal network structure (collector network) will be laid out.** The description should include a breakdown of how the individual turbines are connected together as well as how they are connected back to the wind farm substation. Please specify different cable sizes and individual lengths of cable.

Name of internal network structure attachment

	Type 1	Type 2	Type 3
47. Conductor cross sectional area per core (mm²)			
48. Conductor type (Al, Cu, etc)			
49. Type of insulation			
50. Charging capacitance (μF/km)			
51. Charging current (A/km)			
52. Positive sequence resistance ($R_1\Omega$/km)			
53. Positive sequence reactance ($X_1\Omega$/km)			
54. Zero sequence resistance ($R_0\Omega$/km)			
55. Zero sequence reactance ($X_0\Omega$/km)			

GRID CONNECTED TRANSFORMER DATA

There are many types of transformers. This application form specifies Two Winding Transformers. All impedances should be stated in % on transformer rated MVA base.

Please note that the connection voltage is determined by EirGrid in accordance with normal standards, as detailed in the Grid Code, taking into account the particulars of each development. If the connection voltage differs from that specified in the Application, EirGrid will request new data corresponding to the new voltage level. An appropriate connection voltage will initially be examined as part of this application check.

Please note the Grid Connected Transformer specified must be compliant with section WFPS1.6.5 of the Grid Code.

Please note that a full manufacturers test report will be required at a later stage.

Noted ☐

56. **State number of transformers proposed at the electrical connection point(s).**

TECHNICAL DETAILS REQUIRED

GRID CONNECTED TRANSFORMER DATA – CONTINUED

	Transformer 1	Transformer 2
57. Rating of Transformer (MVA)		
58. Temperature above rating is based on (°C)		
59. Transformer voltage ratio HV/LV (kV)		
60. Transformer positive sequence resistance (R_1%)		
61. Transformer positive sequence reactance (X_1%)		
62. Transformer zero sequence resistance (R_0%)		
63. Transformer zero sequence reactance (X_0%)		
64. Transformer vector group		
65. Please provide details of tap changer. Nature of tap changer (off load/on load/off circuit)		

Transformer 1:	Tapped voltage winding		kV	+	Steps	–	Steps	%	Step Size
Transformer 2:	Tapped voltage winding		kV	+	Steps	–	Steps	%	Step Size

STATION DATA

66. **Please specify the Maximum Import Capacity (MIC) required.** This is the amount of import capacity that the site will require during start up and will be provided for in the connection offer.

☐ **MVA**

67. **Please Specify the House Load required for the site under normal operating conditions.**

☐ **MW** ☐ **Mvar**

68. **Please state if a separate transmission connection is required to supply House Load.**

Yes ☐ **No** ☐

If required please submit details. Name of attachment

GENERATION DATA FOR FAULT STUDIES (SHORT CIRCUIT)

69. **Please provide the following currents for each type of wind turbine generator used in the wind farm.**

	Type 1	Type 2	Type 3
I_K'' – Initial symmetrical short circuit current			
I_P – Peak short circuit current			
Ib_{100} – Short circuit breaking current at 100ms			
Ib_{80} – Short circuit breaking current at 80ms			
I_K – Steady state short circuit current			

70. **Please provide a short circuit decrement curve (current vs. time) that represents each type of wind turbine generator used in the wind farm. Name of attachment(s)**

TECHNICAL DETAILS REQUIRED

DYNAMIC SIMULATION DATA

For EirGrid to be able to carry out dynamic simulations the applicant needs to submit a dynamic model appropriate for their wind farm. This dynamic model should be available from the manufacturer and should be compliant with the Grid Code Planning Code Appendix PCA.4.10.1.

The dynamic model can be provided to the TSO in two ways:
i. Electronic attachment to this application
ii. The applicant can provide an unambiguous reference to a dynamic model previously provided to the TSO appropriate for the wind farm.

If all the wind turbine generators in the wind farm are not identical the model should incorporate separate modules to represent each type of wind turbine generator. Appropriate data and parameter values should be provided for each model. The model should be supplied in PSS/E format or in such other format as agreed between the wind farm and the TSO.

71. Please indicate if a dynamic model appropriate for this wind farm has already been submitted to the TSO.

Yes ☐ **No** ☐

If Yes please answer questions 72–77, otherwise skip to question 78.

72. Name of dynamic model previously submitted to TSO.

73. Version number of this model.

74. Date this model was submitted to the TSO.

75. The name of the TSO recipient of the model.

76. The sender (name and company) of this model.

77. Specify by what method this model was sent to the TSO, (eg. email, CD etc).

Please skip to question 80.

78. Name of dynamic model submitted electronically with this application form.

79. Version number of this model.

80. Please note the dynamic model specified in either questions 72–77 or questions 78–79 must be compatible with the version(s) of PSS/E currently in use by the TSO. Please refer to the document Dynamics Model Register on www.eirgrid.com to check for this version(s).

Noted ☐

81. Please state which version(s) of PSS/E this dynamic model is compatible with.

APPENDIX A

HOW TO DERIVE THE GRID CO-ORDINATES FROM “DISCOVERY SERIES” ORDNANCE SURVEY MAP

Easting and Northing co-ordinates should be stated to six places. Easting co-ordinates are the numbers on the horizontal axis. Northing co-ordinates are the numbers on the vertical axis.

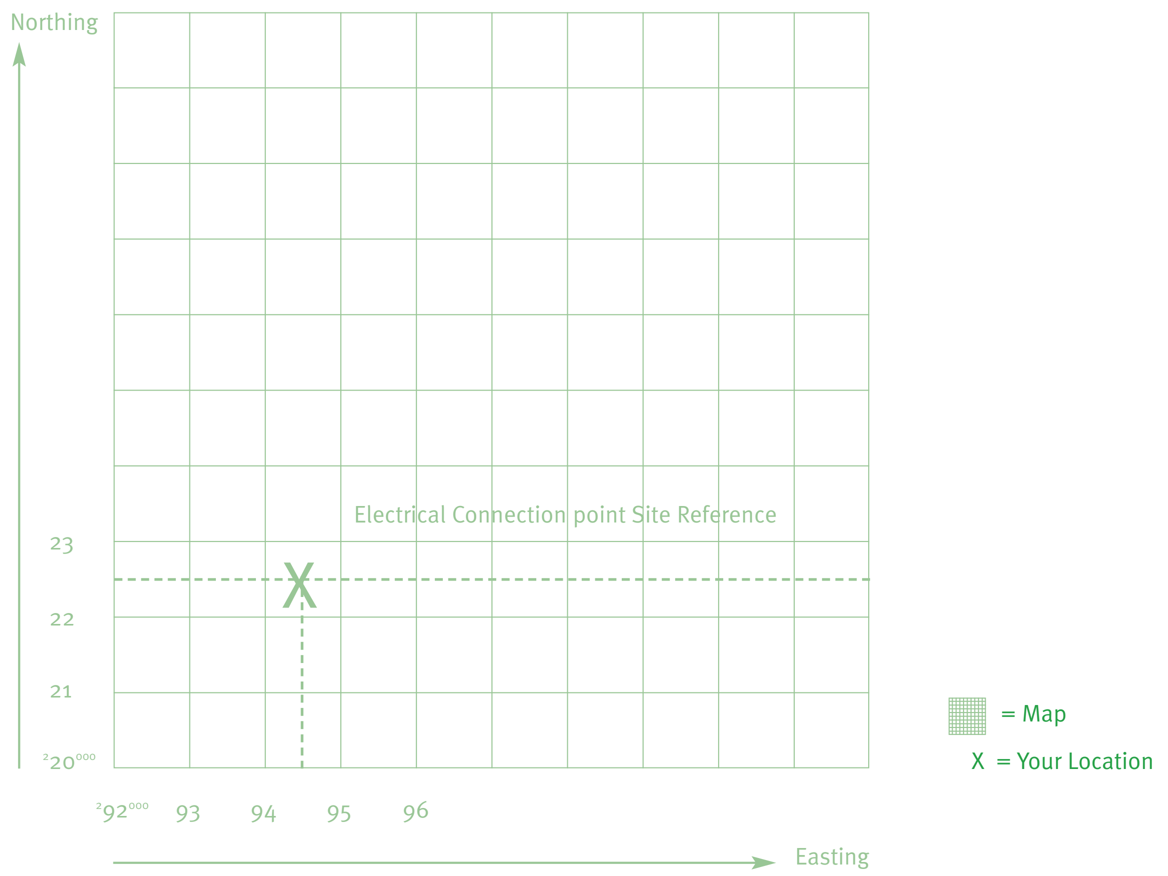

FIGURE 1. EXAMPLE OF A DISCOVERY SERIES MAP GRID

Site co-ordinates: Easting 294500, Northing 222500

EXAMPLE
The electrical connection point **Easting** co-ordinates are QYYZZZ.

Q refers to the first number (in superscript) of the bottom left hand corner of the map (i.e. 294500 Q=2), YY are the numbers on the horizontal axis directly below the site to the left (i.e. 94). ZZZ is the actual position in the grid expressed from 0 to 999 (e.g. if half way horizontally within the grid square, the Easting number is approximately 500).

The **Northing** co-ordinates are similarly identified, except that the numbers refers to the vertical axis.

CHECKLIST

- Application form completed in full
- Application fee
- Two signed copies of confidentiality agreement (if applicable)
- OS map
- Site plan (hard and soft copy)
- SLD (hard and soft copy)
- Power Curve
- Power Quality Test Report
- Reactive Capability Curve
- Fault Ride Through Capability Test Results
- Internal Network Structure details
- Station Data (if applicable)
- Short Circuit Decrement Curve
- Suitable Dynamics Model