Generation Facilities

Connection Application Form to the Transmission System

October 2015

EIRGRID

Introduction

Please note that Wind Generation has a separate application form.

This application form (version 1.2) outlines the information EirGrid requires to progress an application for connection to the Transmission System. EirGrid recommends that the applicant refers to the customers section of the website www.eirgrid.com for further information on the application process. 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 (≥ 110 kV) and that if an MV (≤< 110 kV) supply is required the applicant should first contact ESB Networks: Tel: +353 850 372 757, www.esb.ie

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 applications list section on www.eirgrid.com once the application is deemed fully complete by EirGrid:

- Project name,
- applicant details (contact name, email address, telephone number),
- received complete date,
- status of application,
- grid co-ordinates of electrical connection point,
- capacity of project (MW).

Please note that if the application is not initially deemed complete, then the received complete [1] date is recorded as the date that all necessary information has been provided to the system operator.

Please note that payment of application fees can only be made via electronic fund transfer into the following account. Cheques are not accepted.

Bank Details:
Barclays Bank Ireland Plc
2 Park Place,
Hatch Street
Dublin 2

Sort Code: 99-02-12
Account Name: EirGrid No 2 Account
Account Number: 42890602
Swift Code: BARCIE2D
IBAN: IE80BARC99021242890602

When the application form is completed please send the form to the below address, or email to OPMO@eirgrid.com

EirGrid
Customer Relations
The Oval,
160 Shelbourne Road,
Ballsbridge,
Dublin 4,
Ireland.

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

If any queries arise please do not hesitate to contact our Customer Relations Team at, CUSTOMER.SUPPORT@eirgrid.com

[1] More information on the Received Complete Date is available at: http://gridshare/sites/FG/CPC/CPC%20Policy%20Documentation%20Project/Basis%20for%20calculating%20%20Received%20Complete%20Date%20-%20FINAL.pdf

Details of Applicant

1. Full name of the applicant.

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

Company Registration No. (If applicable)

3. Telephone Number

4. Contact Person(s)

5. Email Address

6. Contact Address (if different)

7. 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.
Please refer to Appendix A for EirGrid's policy on User Site/Station Naming.

8. Please specify the address of this Facility.

9. 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.

Noted ☐

10. Please confirm if you have achieved planning permission for the facility.

Yes ☐ No ☐

If yes, please confirm the planning authority reference.

____

If no, please confirm when you expect to achieve it. If the date of application is dependent on the connection offer date, please confirm the expected number of months to achieve planning permission for the facility.

Months ☐

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

Yes ☐ No ☐

12. Has the Applicant previously had a pre-feasibility study regarding this facility completed by TSO?

If yes, please specify name and the date of issue of the Pre-feasibility study(s).

Yes ☐ No ☐

Study 1: (D/M/Y)

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Study 2: (D/M/Y)

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Maps and Diagrams

13. Please provide a 1:50,000 “Discovery Series” Ordnance Survey map, with the location address 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

14. 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 and

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 soft copy.

Name of site plan attachment:

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15. Please provide an electrical Single Line Diagram (SLD) of the proposed facility detailing all significant items of plant and their values.

- Relevant voltage levels,
- generator transformer(s),
- power factor correction devices,
- location of alternative connection for house load (if applicable) and
- grid connected transformer(s).

Name of the SLD attachment, should be submitted in soft copy.

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16. Please provide a functional block diagram of the main plant components, showing boilers, turbines, heat recovery boilers, alternators, any heat or steam supplies to other processes etc. The functional block diagram must indicate whether single or separate shaft is to be utilised in the case of CCGT.

Noted ☐

General Data

Technical details required

17. Maximum Export Capacity (MEC) required. This is the amount of exporting transmission capacity that will be provided for in the connection offer and is the maximum capacity that can be exported onto the transmission system.

MEC ____________ (MW)

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

____

Please also state any specific connection method requests e.g. the use of underground cabling or connection to a specific station etc.

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Please note that while underground cabling may be quicker to build than overhead line, however it is more expensive and in certain areas of the country the use of underground cabling can have impacts on the Transmission System. For example amplification of background harmonic distortion, that would require additional equipment to be installed to mitigate their impact.

Where the possibility of harmonic amplification exists more detailed studies are required during the process leading to the issuance of a Connection Offer which may not be possible to complete within the standard 90 business day timeframe. Please also note that customers pay for 50% of the least cost connection method. Customer requested connection methods above and beyond the least cost connection method are fully chargeable to customers.

Further information on this aspect of charging policy is available at:
http://www.eirgridgroup.com/customer-and-industry/general-customer-information/connections-and-contracts/

19. Confirm whether you wish the connection offer to issue on a contested or a non-contested basis and broadly outline the works the customer wishes to contest.

Further information on contestability is available at:
http://www.eirgridgroup.com/site-files/library/EirGrid/Contestability-and-Connection-Assets.pdf

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20. Please provide details of the expected running regime. (E.g. base load, peaking etc.)

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Plant Capability Data

Generator capabilities must comply with the Grid Code. Please review the connection conditions for a list of the required standards.

	Unit 1	Unit 2	Unit 3
21. Type of generation plant (hydro, combined cycle, combustion turbine, steam turbine, gas turbine etc.)			
22. Primary Fuel Source			
23. Secondary Fuel Source			
24. Manufacturer of generator			
25. Model and type of above generator			
26. Type of generator (synchronous, asynchronous, etc.)			
27. Number of generators of type			
28. Generator voltage (kV)			
29. Generator rated MVA			
30. Maximum continuous generation capacity at normal operating air conditions(1) (MW).			
31. Minimum continuous generating capacity (MW)			

(1) Normal operating air conditions to be assumed = 10°c, 1.01bar, 70% humidity.

Please note that the sum of the maximum continuous generation capacity at normal operating air conditions for the individual generators unit shall be used to record the Installed Plant (as defined in the Grid code) for the purposes of the connection offer.

32. Please provide a reactive capability curve for the entire active power operating range for each generator as provided at the alternator terminals and at normal operating conditions. Please note that the reactive power capability of each generator must be in compliance with Grid Code ref CC 7.3.6

Name of the attachment:

33. Please state the power factor ranges of each unit as provided at the alternator terminals and at normal operating air conditions at the specified active power percentages of the maximum continuous export capacity and then specify the equivalent MVAr capability.

		35%		100%	
		Ind.	Cap.	Ind.	Cap.
Type 1	Equivalent MVAr				
Type 2	Equivalent MVAr				
Type 3	Equivalent MVAr				

Grid Connected Transformer Data

There are many types of transformers. This application form specifies two and three winding transformers. Please fill in relevant section. All impedances should be stated in % on transformer 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 to 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 the application check.

34. Please note the Grid Connected Transformer specified must be compliant with sections CC.7.2.5 & CC.7.3.9 of the Grid Code.

Noted ☐

Station Data

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

MIC [ ] (MVA)

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

[ ] MW [ ] MVAr

37. 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)

	Unit 1	Unit 2	Unit 3
38.X_d' – Generator Direct Axis Transient Reactance (unsaturated): (pu on machine MVA base)			
39.X_d – Generator Direct Axis Transient Reactance (saturated): (pu on machine MVA base)			
40.X_d'' – Generator Sub-transient Reactance (unsaturated): (pu on machine MVA base)			
41.X_d'' – Generator Sub-transient Reactance saturated): (pu on machine MVA base)			
42.X_2 – Generator Negative Phase Sequence Synchronous			

Reactance: (pu on machine MVA base)			
43.X_0 – Generator Zero Phase Sequence Reactance: (pu on machine MVA base)			

Dynamic Simulation Data

For EirGrid to be able to carry out dynamic simulations the applicant needs to submit dynamic simulation information appropriate to their facility. Please select one of the following ways for providing the dynamic simulation data:

A.The applicant can submit a soft copy of a PSSE Dynamic Model representation of the generation facility connected to a simple grid system. Please see the EirGrid website for general details on how to prepare a sample PSSE model of a connection:
http://www.eirgridgroup.com/customer-and-industry/becoming-a-customer/generator-connections/ ☐
OR

B.The applicant can submit the specific dynamic simulation data requested in Appendix C, D, E and F. ☐

Please note that exact information and parameters regarding excitation, governor systems and power system stabiliser will be required at the time of commissioning.

44. Please submit the open-circuit generator magnetic saturation curve. If this data is not available at this stage EirGrid will assume the magnetic saturation characteristics for the generator to be in accordance with Appendix C.

Complete tick the appropriate boxes for the following section:
Please assume generator magnetic saturation curve as per Appendix C, ☐
OR

Please assume other generator magnetic saturation curve. ☐

Name of attachment specifying curve:

____

Appendixes

Appendix A:
EirGrid's policy on User Site/Station Naming.

- Station name must be unique and pronounceable for all stations,
- station name must be geographically accurate and descriptive,
- station name should be as local as possible to provide for future proofing for other stations that may locate in the same area,
- station names should be identified in the following order;
  - town land it is situated in,
  - nearby town land,
  - Adjacent landmark, i.e. a mountain
- Station Names should not be named after a company, any individual supplier or manufacturer as this is liable to change and
- station name must not start with the letter X as this is reserved for ETSO.

Note: Station name above applies to both the transmission station name and the users site name.

EirGrid will also assign a unique 3 character code to each generation unit which are used by various software for modelling purposes and dispatch purposes. This 3 character code is based on the user site name and the number of generators at that site.

Appendix B:
Three Winding Transformers

Transformer 1

	HV winding	LV1 winding	LV2 winding
B1. Transformer rated MVA			
B2. Transformer rated voltage (kV)			
B3. Transformer vector group			

Transformer 2

	HV winding	LV1 winding	LV2 winding
B4. Transformer rated MVA			
B5. Transformer rated voltage (kV)			
B6. Transformer vector group			

Clearly specify the MVA base (in space provided between brackets) which the measured impedances below are related to:

	Transformer 1	Transformer 2
B7. Transformer positive sequence resistance (R_{1HL1}%) between HV/LV_1:	( )	( )
B8. Transformer positive sequence reactance (X_{1HL1}%) between HV/LV_1:	( )	( )
B9. Transformer zero sequence resistance (R_{0HL1}%) between HV/LV_1:	( )	( )
B10. Transformer zero sequence reactance (X_{0HL1}%) between HV/LV_1:	( )	( )
B11. Transformer positive sequence resistance (R_{1HL2}%) between HV/LV_2:	( )	( )
B12. Transformer positive sequence reactance (X_{1HL2}%) between HV/LV_2:	( )	( )
B13. Transformer zero sequence resistance (R_{0HL2}%) between HV/LV_2:	( )	( )
B14. Transformer zero sequence reactance (X_{0HL2}%) between HV/LV_2:	( )	( )
B15. Transformer positive sequence resistance (R_{1L1L2}%) between LV_1/LV_2:	( )	( )

B16. Transformer positive sequence reactance (X_{1L1L2}%) between LV_1/LV_2:	( )	( )
B17. Transformer zero sequence resistance (R_{0L1L2}%) between LV_1/LV_2:	( )	( )
B18. Transformer zero sequence reactance (X_{0L1L2}%) between LV_1/LV_2:	( )	( )
B19. Transformer positive sequence resistance (R_{1HL1L2}%) between $HV/(LV_1+LV_2)$:	( )	( )
B20. Transformer positive sequence reactance (X_{1HL1L2}%) between $HV/(LV_1+LV_2)$:	( )	( )
B21. Transformer zero sequence resistance (R_{0HL1L2}%) between $HV/(LV_1+LV_2)$:	( )	( )
B22. Transformer zero sequence reactance (X_{0HL1L2}%) between $HV/(LV_1+LV_2)$:	( )	( )

B23. 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

Appendix C:

Generator Data

	Unit 1	Unit 2	Unit 3
C1. X_d – Generator Direct Axis Positive Phase Sequence Synchronous Reactance: (pu machine MVA base)			
C2. X_q – Generator Quadrature Axis Positive Phase Sequence Synchronous Reactance: (pu machine MVA base)			
C3. X_q' – Generator Quadrature Axis Transient Reactance (unsaturated): (pu machine MVA base) (Note: Not applicable to induction generators).			
C4. X_l – Armature Leakage Reactance: (pu machine MVA base)			
C5. T_{do}' – Generator Direct Axis Transient Open Circuit Time Constant: (Sec)			
C6. T_{do}'' – Generator Direct Axis Subtransient Open			
C7. T_{qo}' – Generator Quadrature Axis Transient Open Circuit Time Constant: (Sec)			
C8. T_{qo}'' – Generator Quadrature Axis Subtransient Open Circuit Time Constant: (Sec)			
C9. H – Inertia of complete turbogenerator including primemover gearbox if fitted (MWs/MVA)			

Appendix D

Magnetisation Saturation Curves

D10. Please submit the open-circuit generator magnetic saturation curve. If this data is not available at this stage EirGrid will assume the magnetic saturation characteristics for the generator to be in accordance with figure below.

Complete tick the appropriate boxes for the following section:

Please assume generator magnetic saturation curve as per Figure 1. ☐

OR

Please assume other generator magnetic saturation curve. ☐

Name of attachment specifying curve:

p.u. Saturation Function S(x)

S(1.0)=0.10

S(1.2)=0.33

The saturation function is defined in terms of the open terminal voltage versus field current characteristics shown below in Figure 1. From this figure we define: S(1.2)=(A1.2-B1.2)/B1.2

S(1.0)=(A1.0-B1.0)/B1.0

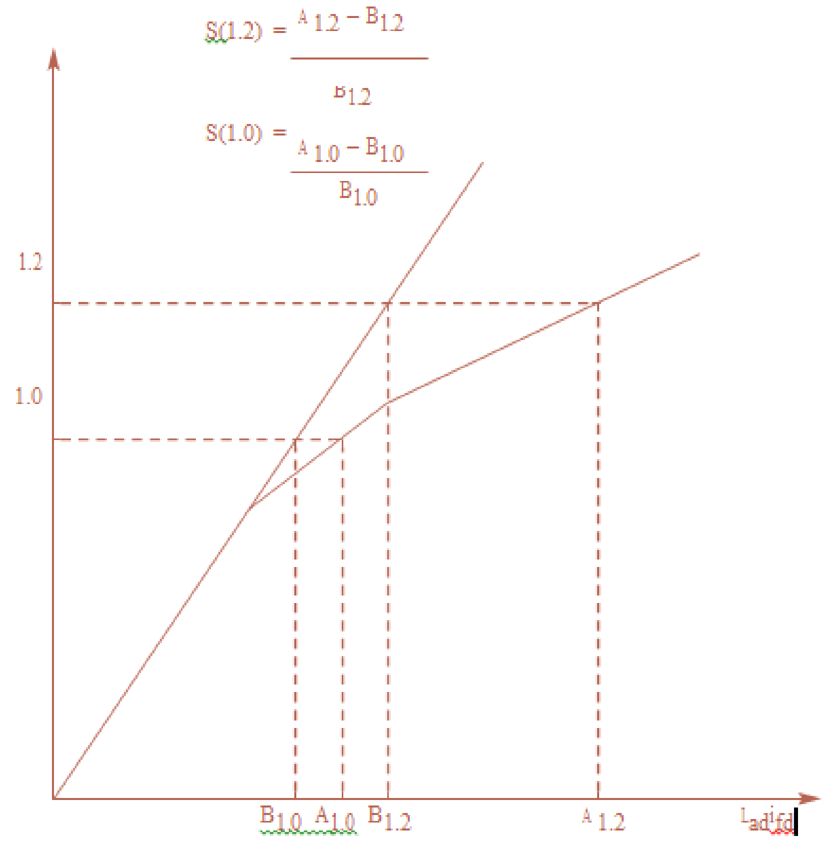

Figure 1: Magnetisaton Saturation Curve

Appendix E
Excitation System

E1. Please submit a Laplace-domain control block diagram that represents the generator excitation system in accordance with IEEE standard excitation models or as otherwise agreed with EirGrid. This control block diagram should specify all time constants and gains to fully explain the transfer function from the compensator or generator terminal voltage and field current to generator field voltage.
A list of acceptable IEEE standard excitation models available within the PSS/E simulation package used by EirGrid is shown below.

Excitation System Models
Below is a list of the standard excitation system models contained in the PSS/E dynamics model library.

ESAC1A 1992 IEEE type AC1A excitation system model
ESAC2A 1992 IEEE type AC2A excitation system model
ESAC3A 1992 IEEE type AC3A excitation system model
ESAC4A 1992 IEEE type AC4A excitation system model
ESAC5A 1992 IEEE type AC5A excitation system model
ESAC6A 1992 IEEE type AC6A excitation system model
ESAC6A 1992 IEEE type AC6A excitation system model
ESAC8B Basler DECS model
ESDC1A 1992 IEEE type DC1A excitation system model
ESDC2A 1992 IEEE type DC2A excitation system model
ESST1A 1992 IEEE type ST1A excitation system model
ESST2A 1992 IEEE type ST2A excitation system model
ESST3A 1992 IEEE type ST3A excitation system model
ESST4B IEEE type ST4B potential or compounded source-controlled rectifier exciter
EX2000 EX2000 Excitation system
EXAC1 1981 IEEE type AC1 excitation system model
EXAC1A Modified type AC1 excitation system model
EXAC2 1981 IEEE type AC2 excitation system model
EXAC3 1981 IEEE type AC3 excitation system model
EXAC4 1981 IEEE type AC4 excitation system model
EXBAS Basler static voltage regulator feeding dc or ac rotating exciter model
EXDC2 1981 IEEE type DC2 excitation system model
EXELI Static PI transformer fed excitation system model
EXPIC1 Proportional/integral excitation system model
EXST1 1981 IEEE type ST1 excitation system model
EXST2 1981 IEEE type ST2 excitation system model
EXST2A Modified 1981 IEEE type ST2 excitation system model
EXST3 1981 IEEE type ST3 excitation system model

IEEET1 1968 IEEE type 1 excitation system model
IEEET2 1968 IEEE type 2 excitation system model
IEEET3 1968 IEEE type 3 excitation system model
IEEET4 1968 IEEE type 4 excitation system model
IEEET5 Modified 1968 IEEE type 4 excitation system model
IEEEX1 1979 IEEE type 1 excitation system model and 1981 IEEE type DC1 model
IEEEX2 1979 IEEE type 2 excitation system model
IEEEX3 1979 IEEE type 3 excitation system model
IEEEX4 1979 IEEE type 4 excitation system,1981 IEEE type DC3 and 1992 IEEE type DC3A models
IEET1A Modified 1968 IEEE type 1 excitation system model
IEET1B Modified 1968 IEEE type 1 excitation system model
IEET5A Modified 1968 IEEE type 4 excitation system model
IEEX2A 1979 IEEE type 2A excitation system model
SCRX Bus or solid fed SCR bridge excitation system model
SEXS Simplified excitation system model
URST5B IEEE proposed type ST5B excitation system (obsolete)
URST5T IEEE proposed type ST5B excitation system

Shunted Fed Excitation Model with Typical Parameters
Figure 2 represents the excitation model assumed. Parameters are set so to bypass the negative current logic. SCRX

Value	Description
0.1	TA/TB
10	TB (seconds)
200	K
0.05	TE (seconds)
0	EMIN
4	EMAX
0	CSWITCH

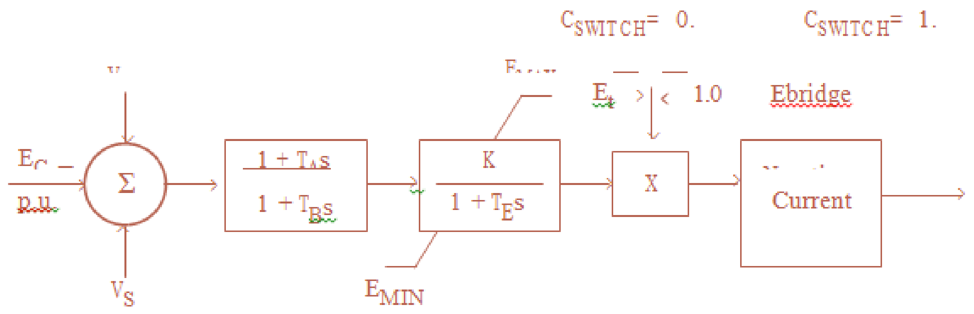

Figure 2: Shunted Fed Excitation Model with Typical Parameters

Appendix F
Power System Stabiliser (PSS)

F1. Please provide the details of the proposed Power system stabiliser (PSS) to be installed.

Noted ☐

Name of attachment:

Appendix G
Turbine – Governor System Models

G1. Please submit a Laplace-domain control block diagram that represents the generator's turbine-governor system in accordance with IEEE standard turbine-governor models or as otherwise agreed with EirGrid. This control block diagram should specify all time constants and gains to fully explain the transfer function from the compensator or generator terminal voltage and field current to generator field voltage.

A list of acceptable IEEE standard turbine-governor models available within the PSS/E simulation package used by EirGrid is shown below.

Complete the following section as appropriate:

A. Please assume model from list below.

Name of attachment detailing the data parameters for the specified turbine-governor model:

OR

B. Please assume other model:

Name of attachment specifying model and all necessary data parameters:

OR

C. If turbine-governor system data is not available at this stage EirGrid will assume a standard model with corresponding parameters for the turbine-governor system. The assumed turbine-governor model for dynamic simulation is detailed in Figure 3 below.
Please assume the model detailed in Figure 3 as our turbine-governor system.

Below is a list of the standard turbine-governor system models contained in the PSS/E dynamics model library.

CRCMGV Cross compound turbine-governor model
DEGOV Woodward diesel governor model
DEGOV1 Woodward diesel governor model
GAST Gas turbine-governor model
GAST2A Gas turbine-governor model
GASTWD Gas turbine-governor model
HYGOV Hydro turbine-governor model
IEEEG1 1981 IEEE type 1 turbine-governor model
IEEEG2 1981 IEEE type 2 turbine-governor model
IEEEG3 1981 IEEE type 3 turbine-governor model
IEESGO 1973 IEEE standard turbine-governor model
PIDGOV Hydro turbine and governor model
TGOV1 Steam turbine-governor model
TGOV2 Steam turbine-governor model with fast valving
TGOV3 Modified IEEE type 1 turbine-governor model with fast valving
TGOV5 Modified IEEE type 1 turbine-governor model with boiler controls
WEHGOV Woodward electronic hydro governor model
WESGOV Westinghouse digital governor for gas turbine
WPIDHY Woodward P.I.D. hydro governor model

Governor System Model Typical Parameters

Value	Description
0.04	R
0.5	T1(>0) seconds
0.85	Vmax
0.2	Vmin
2	T1(>0) seconds
7	T1(>0) seconds
0	Dt

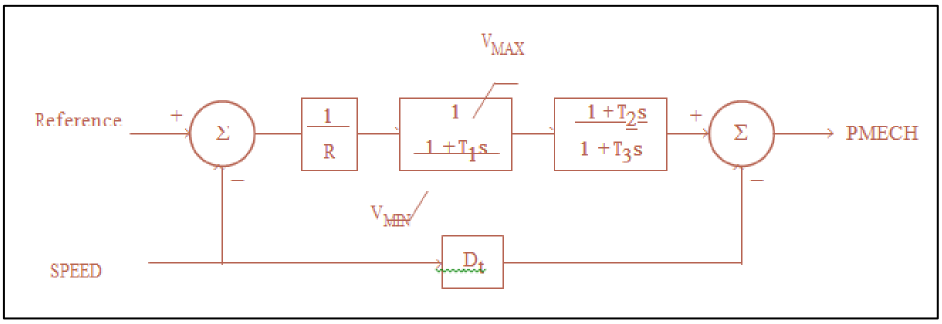

Figure 3: Turbine – Governor System Model

Appendix H:
Checklist:

- Application form completed in full,
- application fee,
- two signed copies of confidentiality agreement (if applicable),
- OS map,
- single line diagram (SLD), soft copy,
- site plan (soft copy),
- soft copy power curve,
- functional block diagram of plant,
- reactive power capability curve and
- dynamic model of facility if applicable.