

Annexure-3(D): Guidelines for Model Compatibility and Support for Conventional generating (Thermal, Gas & Hydro) plants, Bulk Consumers or Load Serving Entities and Combined (Load and Captive) Generation Complex

1. Model Compatibility and Support Guidelines

- i. Both RMS and EMT models for conventional generating stations and Bulk Consumers / Load Serving Entities and Combined (Load + Captive) Generation Complex shall be submitted. The model shall include auxiliary models such as excitation system model, turbine governor model, AVR and PSS model etc.
- ii. The models shall be compatible with the power system software simulation products as specified by Grid-India below: -
 - a) RMS models shall be compatible with **PSS/E version 35** and above.

Provided that the concerned RLDC may accept the model compatible with version 34 also under special circumstances. The decision in this regard will be at the discretion of the concerned RLDC only.

The RMS models are required to be **generic**¹ models and shall not contain any encrypted or compiled parts, as the system operator must be able to maintain the same without the restrictions of software updates etc.

If there is significant difference in the actual performance of the element vis-à-vis the response of the generic model, then **user defined model (UDM)** shall also be submitted in addition to the generic RMS models.

In case of submission of User Defined Models (UDMs), the submission of the **source code and compiling procedure** along with the model is mandatory.

Further, a comparison report highlighting the difference between the simulation response obtained from the generic model and UDM shall be submitted.

- a) EMT models shall be compatible with PSCAD version 4.6.3 and above with the following –
 - i. Intel 15 Update 5 and newer (32-bit) and Visual Studio 2015 and newer
 - ii. Intel 15 Update 5 and newer (64-bit) and Visual Studio 2015 and newer

¹ **Annexure-3(A), 3(B) and 3(C)** may be referred for submitting generic RMS modelling data of Thermal, Gas and Hydro Plants respectively

- iii. Model works across a range of time steps and does not require a specific time step

These models must not be dependent on a specific Intel Visual FORTRAN version and should not have dependencies on additional external commercial software.

iii. The simulation models (applicable for generic and UDMs) shall:

- a) Be submitted in the form of generating units/load connected to the representation of the Grid (Thevenin-equivalent) SMIB (Single Machine Infinite Bus) model.
 - b) Be supported by model descriptions that, as a minimum, shall include Laplace domain transfer functions (for RMS models), and function descriptions of the arithmetical, logical and sequence-controlled modules used in the simulation model.
 - c) Include descriptions of the individual model components and related parameters including saturation, non-linearity, dead band, time delays and constraint functions (non-wind-up/anti wind-up) etc.
 - d) Include descriptions of the set-up of the simulation model as well as any limitations to the application hereof. There shall be no initialization errors for the dynamic models. The warning messages shall be reviewed and resolution or explanation shall be provided.
 - e) Work for a range of dynamic simulation solution parameters rather than for specific settings only.
- iv) Any model validity limitations due to system impedance or strength or any other reason shall be clearly defined.
 - v) Models shall not show any characteristics that are not present in the actual HVDC response.
 - vi) **Model user guide** including model setup procedure, RMS & EMT software version, compiler, visual studio version etc. shall be submitted along with the model.
 - vii) Model limitations, maximum solution time step etc. to be included in user guide
 - viii) EMT model shall not contain any dependent libraries. The submitted workspace file (.pswx) must not load any PSCAD library (.pslx) files apart from the PSCAD master library. The model shall be capable of running with no extra steps aside from clicking "Run" option in PSCAD.