



GOVERNMENT OF INDIA
MINISTRY OF POWER



SIMULATOR TRAINING PROGRAMS AT NPTI



NATIONAL POWER TRAINING INSTITUTE

An ISO 9001:2015 & 14001:2015 Organization

Ministry of Power, Government of India

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ABOUT SIMULATOR

Simulators play a pivotal role in the training process within the power industry, serving as one of the most effective tools to ensure high-quality, consistent training. They offer a unique opportunity for trainees to experience real-time scenarios across the full spectrum of operations, enhancing both knowledge and practical skills in managing critical plant operations.

1.1 Introduction & Need of Simulator Systems

The power industry has undergone significant changes over recent years, necessitating the implementation of more effective, systematic training programs. To ensure the safety, stability & efficiency of power plants, it is essential to harness the full potential of human resources—operators who are capable of making fast, informed decisions. The result is fewer plant trips, trouble-free start-ups, better plant subsystem analysis, optimal use of resources, extended equipment life, and lower downtime and costs.

To address the growing demand for advanced training methods in the power sector, National Power Training Institute (NPTI) has continuously evolved its training methodologies. This includes the installation of state-of-the-art simulators, which have become a widely accepted methodology for improving plant performance, availability, and safety. NPTI's efforts include the establishment of various simulators for thermal, hydro, gas, and combined cycle power plants, as well as for SCADA and smart grid systems.

1.2 Simulators at NPTI

NPTI, a global leader in power training, operates an extensive range of simulators across seven regional institutes. These simulators replicate real-time operations of various power plants, enabling hands-on training in a controlled, risk-free environment. NPTI has simulators for coal-based thermal plants (ranging from 210 MW to 800 MW), hydro power plants (250 MW), gas-based plants (Siemens and GE makes), and combined systems for smart grids and SCADA operations.

NPTI operates its Simulators through its Institutes in different regions on all India basis :

A. Northern Region

NPTI Corporate Office, Faridabad	1.Simulator of Coal based 210MW/500MW 2.Simulator of Coal based Supercritical 800MW 3.Combined Cycle Gas Turbine Simulator GE Make 550 MW and Siemens make Simulator 440 MW 5.Hydro Simulator 250MW 6.Simulator on SCADA and Smart grid
NPTI Nangal (Hydro Power Training Centre)	1. Hydro Simulator(250MW)

B. Southern Region

NPTI Bengaluru (Power System Training Institute)	1. DTS Simulator 2. Simulators of Coal based 210MW/500MW/800 MW
NPTI Alappuzha	1.Simulators of Coal based 210MW/500MW/800 MW 2. Hydro Simulator (250MW) 3. Simulator on SCADA and Smart grid

C. Eastern & North Eastern Region

NPTI Durgapur	1. Simulators of Coal base d 210MW/500MW/800MW
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D. Western Region

NPTI Nagpur	1. Simulators of Coal based 210MW/500MW/800MW
NPTI Shivpuri	1.Simulators of Coal based 210MW/500MW/800 MW 2. Hydro Simulator(250MW) 3. Simulator on Smart grid and SCADA

1.3 Organizations Benefitted

NPTI Conducts Simulator training program for the engineers and operators from National and International organizations. Central PSUs, State PSUs, Private Power Producers are regularly utilizing the Simulator facility to train their engineers/operators.

Central PSUs namely NTPC,SJVNL,NHPC,DVC,NEEPCO,THDC,NLC ,CEA,NFL,ONGC,Grid India & State PSUs, KPCL,MPPGCL,UPRVUNL ,MSPGCL,TANGEDCO,KSEB,GEB,RRVUNL,PPCL,OPGCL have sent their trainees in our Simulators. Also Private Power Companies such as Tata power, L&T Power, Reliance, Aparva , Toshiba to name few have availed our Simulator facilities including international organizations such as Petroleum Development Oman (Oman),AKCS LLC,(Oman) M/s Yugadanvi (Sri lanka),Sudan Power,Sudan, ECN Nigeria,GECOL Libiya, Belenergo for Power,Belarus.

1.4 Photo Gallery



Simulator Training Programs (National & International)

Simulators have been identified as one of the most effective means of delivering consistent high quality training and provide an unique opportunity for the trainees to experience a full range of operations with real time situations.

2.1 Details of Training Program(Content, Duration & Fee)

The Power industry has been experiencing dynamic changes in recent years. To maintain safety, stability and efficiency, the need for effective, systematic training programs is being increasingly felt. The secret of making plant work optimally and safely depends on realizing the potential of human resources (man behind machine). This enables Engineers/Operators making faster and better judgment skills resulting minimum plant trip, Trouble free start-ups, analysis of plant sub-systems, optimum usage of auxiliary resources & extended equipment life, meaning less down time & lower costs.

NPTI is making consistent efforts to improve training methodologies for the betterment of Plant Operation in the Power Sector. In order to improve the plant PLF, Availability and Safety standards, the simulator training is widely accepted methodology for power sector training. NPTI established its first 210 MW Thermal simulator at NPTI Badarpur in eighties. For meeting the power sector demand in higher capacity units, NPTI established two more DAS based Thermal Simulator of 500MW at NPTI Faridabad & 210MW KWU at NPTI, Nagpur in early 2000. Growing complexities in power system led to installation of one of the unique Dispatcher Training Simulator (DTS) at PSTI, Bengaluru, & Combined Cycle Gas Turbine (CCGT) at Faridabad & Hydro Simulator at Nangal, Punjab.

(A) Simulator Training on 210MW/500MW Thermal:

Objective- To train fresh engineers on a full scope replica simulator in all aspects of operation as well as for developing suitable

response to malfunctions and emergency situations by Hands – on
– Practice in all the phases of operation from start-up to shut-down.

Program Profile -

- ☒ Cold start up to 100% load.
- ☒ Partial load to full load and back to partial load
- ☒ Maneuvering of different auxiliaries.
- ☒ Hot start/warm start to full load.
- ☒ Planned shutdown.
- ☒ Over –rides and alarms during different exercises.
- ☒ A few malfunctions.

(B) 800MW Super Critical Thermal Power Plant Training Simulator:

Objective – To train engineers on full scope replica simulator of 800 MW, Super critical coal fired power station in all aspects of operation and helping them to make better, judgment calls/responses to malfunctions and emergent situations by imparting them hands on practice.

Program Profile –

- ☒ Cold start up to 100% load, Hot start/warm start up to full load
- ☒ Planned shut down
- ☒ Auto/manual control of parameters
- ☒ Operation under emergency conditions

(C) Combined Cycle Gas Turbine (CCGT) Power Plant Simulator Training (430 MW Siemens & 550 MW GE):

Objective – To train engineers on full scope replica simulator of CCGT Power station, in all aspects of operation and helping them to make better judgment calls/responses to malfunctions and emergent situations by imparting them hands on practice.

Program Profile –

- ☒ Cold start of machine and load up to 100% load

- ☒ Partial to full load and back
- ☒ Hot start / Warm start to full load
- ☒ Planned Shutdown
- ☒ Maneuvering of different auxiliaries
- ☒ Stand alone Operation of Gas Turbine
- ☒ Operation under emergency conditions
- ☒ Operation of Gas turbine in open Cycle mode

(D) 250 MW Hydro Power Plant Simulator Training:

Objective - To train the engineers on a full scope replica simulator in all aspects of operation as well as for developing suitable response to malfunctions and emergency situations by Hands-on - Practice in all the phase of operation from start - up to shut - down.

Program Profile -

- ☒ Start - up of Machine & load up to 100%
- ☒ Partial load to full load and back to partial load.
- ☒ Maneuvering of different auxiliaries.
- ☒ Planned shutdown.
- ☒ Operation under emergency
- ☒ Over - rides and alarms during different exercises.
- ☒ Few malfunctions & its trends.

(E) Dispatcher Training Simulator at PSTI, Bengaluru:

Objective - To practice the Normal and emergency Operation of Power System, Active and Reactive Power Control and Advanced Applications using Dispatcher Training Simulator (DTS) . : Persons involved in System Operation and Control i.e. Generating Station, Transmission, Load Dispatch Centre, Sub - Station and Distribution Personnel can undertake training .

Program Profile -

- ☒ Dispatcher training Simulator Overview
- ☒ Active and Reactive Power Control
- ☒ Indian National Network including HVDC Lines

- ☒ Prime mover dynamics (Hydro, Steam, Gas and Pumped storage units)
- ☒ Load shedding schemes
- ☒ Islanding schemes
- ☒ SCADA Operation
- ☒ Automatic Generation Control
- ☒ Islanding and Integrated Operation
- ☒ System Occurrence and Restoration
- ☒ System Stability
- ☒ Voltage Control and Voltage Collapse simulation
- ☒ Prevention of Grid Disturbance

(F) SCADA & Smart Grid:

Objective: SCADA and Smart Grid Hands on training on DMS (Distributed Management System), OMS (Outage Management System), EMS (Energy Management System), CMS (Customer Management System), IT/OT etc of the combinations would give a perfect understanding of integrated operation of the associated power system.

Program Profile:

- ☒ Orientation of Network Topology & Distribution Power Flow
- ☒ Fault Isolation and Service Restoration
- ☒ Automatic Feeder Reconfiguration for Load Balancing
- ☒ Load and Voltage / VAR Management and OMS Functions
- ☒ Over Loading, Tripping and clearing system Disturbance of Line/Transformer
- ☒ Frequency Variation Through Generation Trip
- ☒ Voltage Collapse, Black Start Restoration, Cold Load pickup, Loss of RTU and Island Creation

Participants Level	Duration	Batch Size	Training fee per participant (Excluding GST, Boarding & Lodging) in Rs.
Induction Level/GET/ET/AE/JE from state PSU/CPSU/Pvt. Power Generation Company	2 week	12- 15 participants	50,000/-
Experienced Engineers & Plant Managers from state PSU/CPSU/Pvt. Power Generation Company	1 week	12- 15 participants	25,000/-

NPTI Simulator training is regularly conducting for National & International organizations. NPTI conducts the simulator training as per the customized requirements also. NPTI Simulator on 500 MW Thermal / Gas Turbine Simulator has been utilized by the international organizations such as Petroleum Development Oman (Oman), AKCS LLC, (Oman) M/s Yugadanvi (Sri lanka), Sudan Power, Sudan, ECN Nigeria, GECOL Libiya, Belenergo for Power , Belarus.

Center of Specialization

The Simulator and associated equipment system have an existing simulator training centre with classrooms, documentation centre and other infrastructure required for a full fledged training centre. This simulator having different configurations like 210 MW/500 MW/800 MW Thermal Power Plant, 250 MW- Hydro Power Plant, 430 MW/550 MW- Combined Cycle Power Plant, 800 MW Supercritical Power Plant, Smart Grid System are given as below.

3.1 Sub Critical Thermal Power Plant 210MW Simulator

The 210 MW Sub-Critical Power Plant Simulator at NPTI is replica of NTPC's unit #1 of Dadri Project and is fully modular. The protections, interlocks and logics of the real plant are incorporated in the simulation model. The simulator consists of a set of operator stations with all operator functions, instructor's station for instructor tasks, multiple virtual controllers to simulate the exact controls of reference plant, a simulator programming station and HMI stations. The operator interfaces are identical to those in the plant with the different models to provide the complete overview and feel of the plant. Process models simulation will provide a realistic response to operator actions whether during normal, abnormal or emergency operating conditions (Malfunction scenario). The Simulator with associated equipment system at 210 MW Sub-critical Simulator has achieved full load condition with fine tuning process parameters of 151 Kg/ Sq.cm, 539.3 Deg C and 142.2 Tons/hour of Coal Flow.

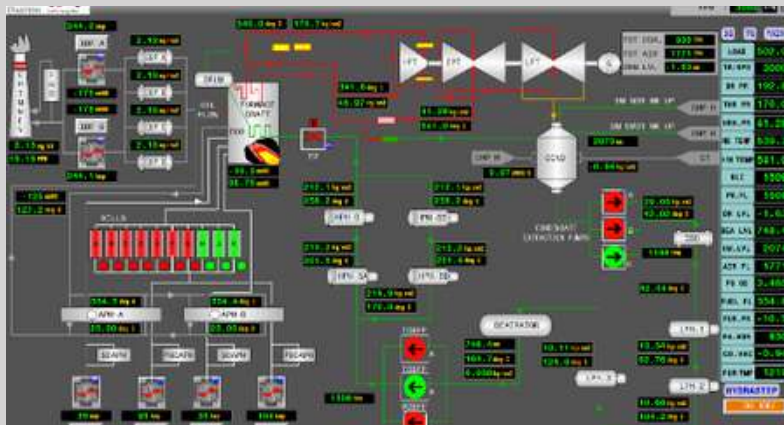


210 MW Sub-critical Simulator

3.2 Sub Critical Thermal Power Plant 500MW Simulator

The 500 MW Sub-Critical Power Plant Simulator at NPTI is replica of NTPC's Unit #7 of Korba Project & is fully modular. Steam generator & Turbine package of replica unit is supplied by M/s BHEL. The protections, interlocks and logics of the real plant are incorporated

in the simulation model. The simulator consists of a set of operator stations with all operator functions, instructor's station for instructor tasks, multiple virtual controllers to simulate the exact controls of reference plant, a simulator programming station and HMI station. The operator interfaces are virtual, identical to those in the plant interfaced with the models to provide the complete look and feel of the plant. The fidelity of the process models provides a realistic response to operator actions whether during normal, abnormal or emergency operating conditions. The Simulator with associated equipments system at 500 MW Sub-critical Simulator has achieved full load condition with fine tuning process parameters of 176 Kg/Sq.cm, 541 Deg C and 334.8 Tons/hour of Coal Flow.

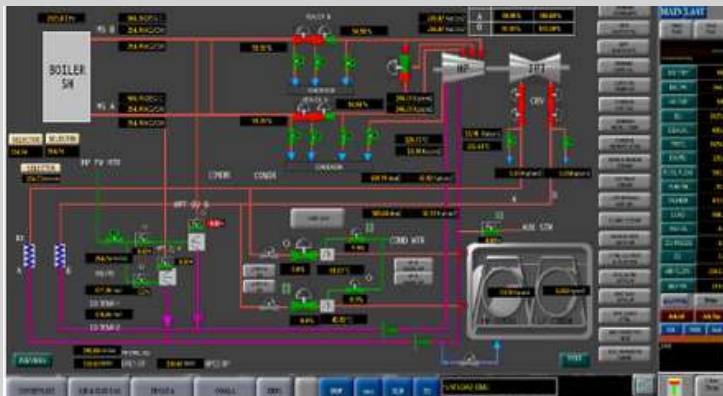


500 MW Sub-critical Simulator

3.3 Supercritical 800 MW Thermal Power Plant

The 800 MW Supercritical Power Plant Simulator at NPTI is based on the replica of Kudgi STPP Project (3X800 MW). Steam Generator of replica unit is supplied by M/s Doosan and Turbine package is supplied by M/s Toshiba. The Simulator & associated equipments at NPTI, Faridabad is housed in an existing Simulator Training Centre with classrooms and other infrastructure facilities for a full fledged training centre. The simulator design includes equipment, instrumentation and controls that enables operator to function in all modes of specified coal fired power plant operation including

normal, abnormal or emergency operating conditions. 800 MW Supercritical Simulator achieved full load condition with fine tuning process parameters of 254 Kg/Cm², 566oC & 2423Tons /hour steam flow. Supercritical plant operation under varying load conditions need optimal parameters and precise regulations in order to match system frequency, therefore the system operator training need to be emphasized parametric regulation of the plants under variety of system conditions, such that the plant is effectively connected with grid and power injection is ensured.

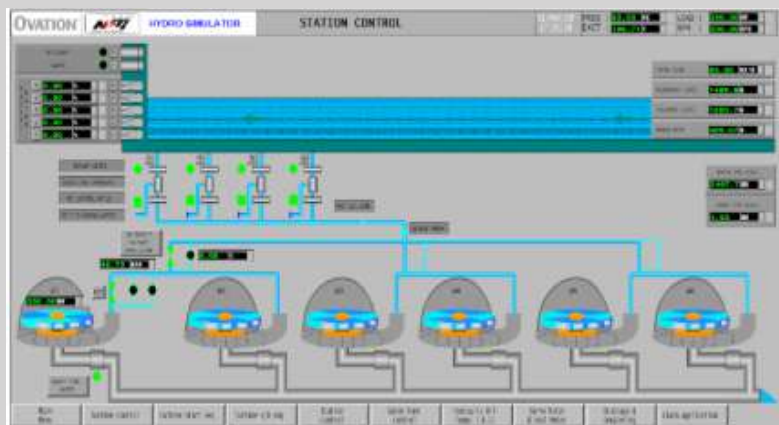


800 MW Supercritical Simulator

3.4 250 MW Hydro Power Plant Simulator

The 250 MW Hydro Power Plant Simulator at NPTI, is replica of SJVNL's Unit #1 of Nathpa Jhakri Hydro Power Plant project and is fully modular. The logics of the real plant are incorporated in the simulation model. The simulator consists of a set of operator stations with all operator functions, instructor's station for instructor tasks, multiple virtual controllers to simulate the exact controls of reference plant, a simulator programming station and HMI stations. The operator interfaces are virtual, identical to those in the plant interfaced with the models to provide the complete look and feel of the plant. The fidelity of the process models provides a realistic response to operator actions whether during normal, abnormal or

emergency operating conditions. The Simulator with associated equipment system at 250 MW Hydro Simulator has achieved full load condition with fine tuning process parameters of rpm 300 and 63.5 Cub m/sec of total water Flow.

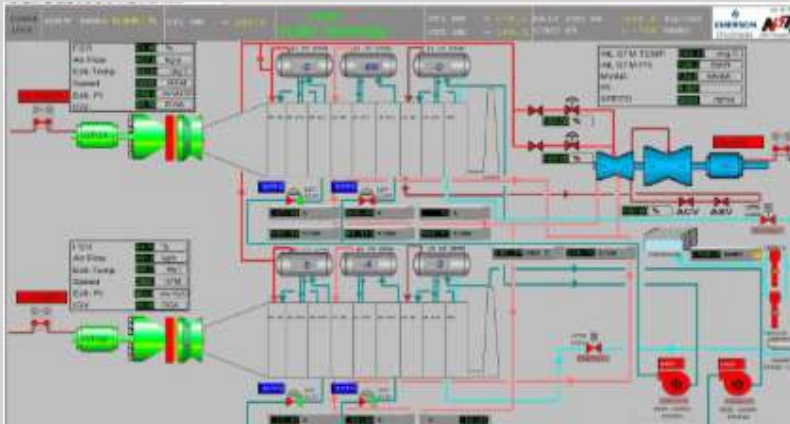


Overview of 250 MW Sub-critical Simulator

3.5 Simulator 550 MW Combined Cycle Power Plant (GE MAKE)

The 550 MW Combined Cycle Power Plant Simulator at NPTI, Faridabad is replica of GE (General Electric) Frame 7FA and is fully modular. The protections, interlocks and logics of the real plant are incorporated in the simulation model. There you will find the two-gas turbine of 172MW each and with one Steam Turbine of 196 MW Combination. Combined Cycle Power Plant Simulator consists of a set of operator stations with all operator functions, instructor's station for instructor tasks, virtual controllers to simulate the exact controls of reference plant and a simulator programming station with LVS system. Plant operator interfaces with mainframe system are identical to those in the plant and provide the complete glance and insight plant operations. The fidelity of the process models along with the mainframe simulation provides a real time response to operator for handling emergency operating conditions. The Simulator with associated equipment system of 550 MW Combined

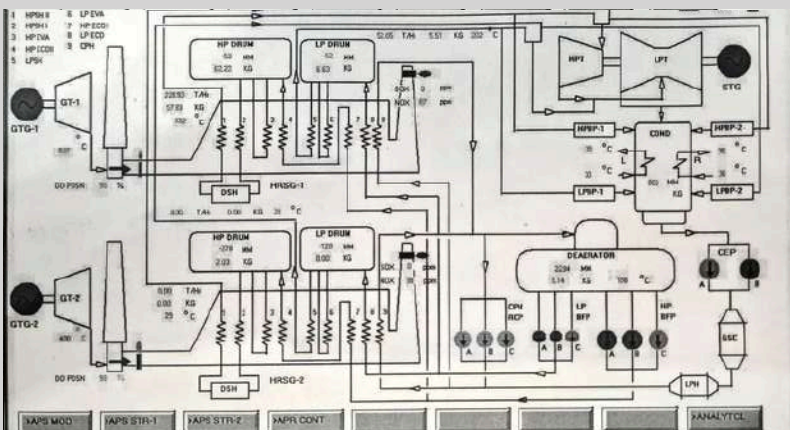
Cycle Simulator has achieved full load condition with fine tuning process parameters of 128.8 Kg/Sq.cm, 553.11 Deg C and 708 mmhg of vacuum. This Simulator has one more feature which is 'Automatic Plant Startup' system, in which the operator will give only one command and the whole Simulator GT-1, GT-2 and ST will start on its own and synchronize the generator with the Grid Automatically in real time operating scenario.



550 MW Combined Cycle Power Plant Simulator

3.6 430 MW CCGT Simulator (SIEMENS MAKE)

It is a replica of 430MW Combined Cycle Gas Turbine NTPC, Faridabad- Gas Power Plant. These are 02 Gas Turbines of 143 MW each and 01 Streams Turbine of 144 MW.



430 MW CCGT Simulator (SIEMENS MAKE)

3.7 SCADA & Smart Grid

The Smart Grid Simulator is designed to provide a realistic environment for system dispatchers for real time simulation of Grid Systems, processes, and grid operations etc. The Smart Grid Simulator uses a dynamic power system model to create a simulated operating environment. The power system model consists of a detailed description of power system components & topology. The Dispatcher Training Simulator uses this model to track unit turbine dynamics, circuit breaker operation, relay action, frequency variations, and generation variations and load variations. The Smart Grid provides control center functions such as Automatic Generation Control (AGC) to give the dispatcher trainee control of the simulated power system. The Smart Grid uses Network data (NETMODEL), Generation data (GENMODEL), SCADA data (SCADAMDL), Prime mover dynamics and relay simulation data (DTSMODEL). The Smart Grid system will be based on Power System Model (PSM) and Control Centre Model (CCM).



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