ISSUES & CHALLENGES IN TRANSMISSION DEVELOPMENT

- Hybrid Transmission System for maintaining critical parameters
- Increase in MW flow per metre of ROW
- Controlling high Short Circuit Levels
- Non-discriminatory Open Access
  - ➢ Market driven exchanges may influence pattern of power flow
  - ➢ Periodic review and strengthening

Necessitates optimal utilization of existing transmission infrastructure by enhancing transmission capacity using emerging technologies at marginal investment

FUTURE ROAD MAP FOR TRANSMISSION SYSTEM

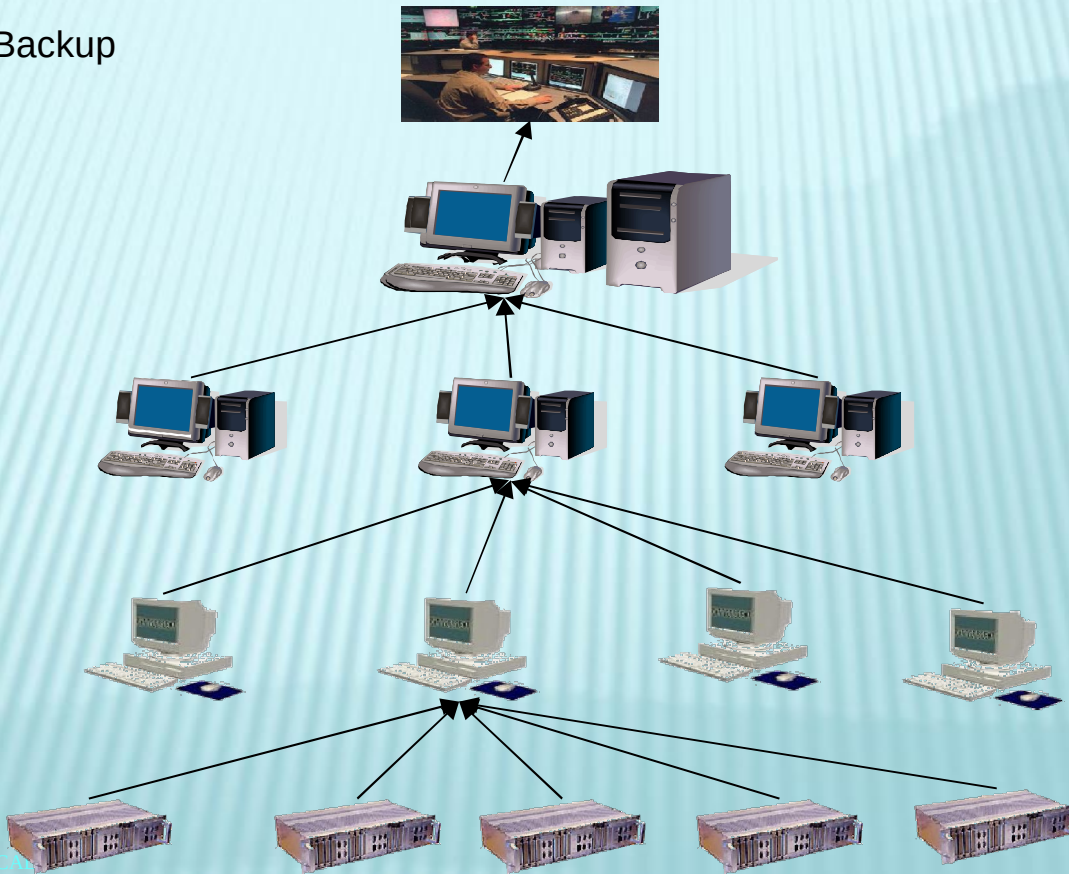
- 1200kV UHVAC test station is under development
- Supergrid comprises hybrid transmission system of 765kV/1200kV AC and ±800kV, 6000MW HVDC system
- Supergrid supported by high capacity 400kV AC & ±500kV HVDC system
- Technology integration to address reactive power management and high short circuit level
- Control features to regulate power flow and maintain system parameters
- Smart Grid with Wide Area Monitoring (WAMs), adaptive islanding

LOAD DISPATCH SYSTEMS IN INDIA

System Operation and Grid Management

- POWERGRID undertook ULDC project under which modernized load dispatch facilities have been established in each of the five regional centres culminating in establishment of a national load dispatch centre in 2009, to ensure resultant system can be operated with reliability, inspite of ever increasing interconnections.
- The national grid is giving platform for meeting growing demand, enable competition in the electricity market and integrate more sustainable generation resources.

LOAD DESPATCH CENTERS ACROSS INDIA



Existing IT Tools for Grid Monitoring/ Operation

The National Grid- a big pool of reservoir of energy for all stakeholders hence, resultant unpredictability and so Continuous monitoring needed.

- ULDC scheme implementation for RLDC
- Integrating regional view by setting up of NLDC
- Remote monitoring & control of S/s
- Substation automation.

What's a Smart Grid

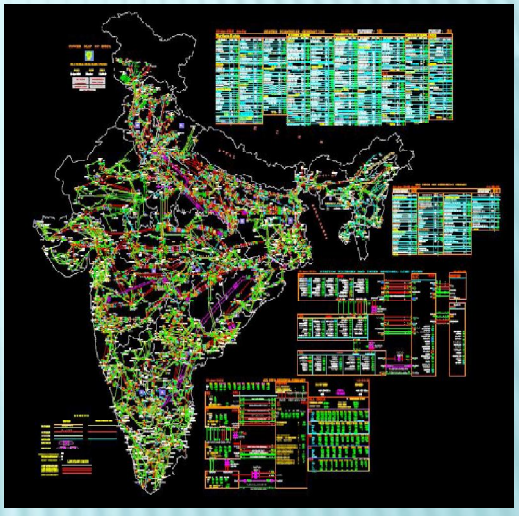
It aims for

- Increasing reliability
- Optimizing grid operations
- Promoting energy efficiency
- Provide higher quality power
- Self healing and Adaptive Islanding
- Enable electricity markets to flourish
- Enabling environmental opportunities
- Fostering renewable and alternative generation
- Facilitates consumers to actively participate in operations of the grid

Hence, Smart Grid is the integration of information and communication technology (ICT) with the energy infrastructure network.

ISSUES & CHALLENGES IN SYSTEM OPERATION

- Static view of system
- Latency and Time skew in Data
- Integration of upcoming Wind and Solar Generations.
- Integration of upcoming IPPs and MPPs
- Integration of Dispersed Generation



Necessitates installation of Intelligent Electronic Devices, Phasor measurement units (PMU) and Wide area Monitoring systems (WAMS) to enhance system operation capabilities and visualization of Unified National Grid.

What is PMU , Synchrophasor & WAMs

- PMU- An electronic device, which gives computed strings of GPS time stamped phasors of voltage & current. Time synchronising technique coupled with computer based measurement technique has helped to measure the phasors and phase angle difference in real time.
- Synchrophasor – Its a technology which puts Phasor measurements from across any portion of the Power System on the same absolute time base.
- WAMS- It's a network of PMUs that can provide real time monitoring on a regional & national scale. It acquires synchronized real time data, throughout the interconnected network.

Benefits of Synchrophasor Technology

Real Time Measurement of state of the Power System by Synchrophasors

- Streaming Highly accurate synchrophasors at a high samplimg rate.
- Outputting accurately GPS time-stamped voltage and current Phasors.
- Time synchronized sub-second data (5 to 50 samples per second), (RTU data every 10-15 seconds on request.)
- Precise information about System State eg Total Transfer capability and Congestion Management
  - Direct monitoring of the swings because Synchronized measurement of phasors provides direct measurement of phase angles with less latency

Benefits of Synchrophasor

- Existing C&I allows CC to monitor & control power flows and, overall decision time window being more than couple of minutes.
- PMU based system will improve speed for grid control necessitated due to its ever increasing capacity addition, unpredictable renewable energy resources and market influenced transactions.
- It will lead to substantially improving efficiency and stability of power system operation through predictive intervention or making the grid, self-healing.

Suitability of WAMs for Large Indian Grid

- Large Geographical Area Coverage (3.3 Million Square Kms)
- Interregional Capacity
  - From present 20800 MW to 37000MW by 2017
- Large Fiber Optic Network on EHV Transmission
- Increasing Stress on Transmission Grids
  - Interconnected Grid
  - Open Access
  - Inter-Regional Power Trading
  - Need for carrying more Megawatts per meter of ROW
- Integration of Renewable (Wind/ Solar etc.)
- Lack of tools for monitoring Dynamic behavior
  - Existing tools are not adequate
  - Monitor & then “Estimate” the steady state
  - Heavy dependence on Dispatcher’s knowledge

Benefits of Synchrophasor Technology

- 1-2 years
  - Angle / Frequency Monitoring
  - Disturbance Analysis
  - Voltage Stability Analysis
- 3-5 years
  - Improved State Estimation (Boundary conditions)
  - Rapid Restoration
- The Future
  - Real-Time Control
  - Early Cascade Detection