TELECOM NEEDS OF POWER SECTOR - TRANSMISSION

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Agenda

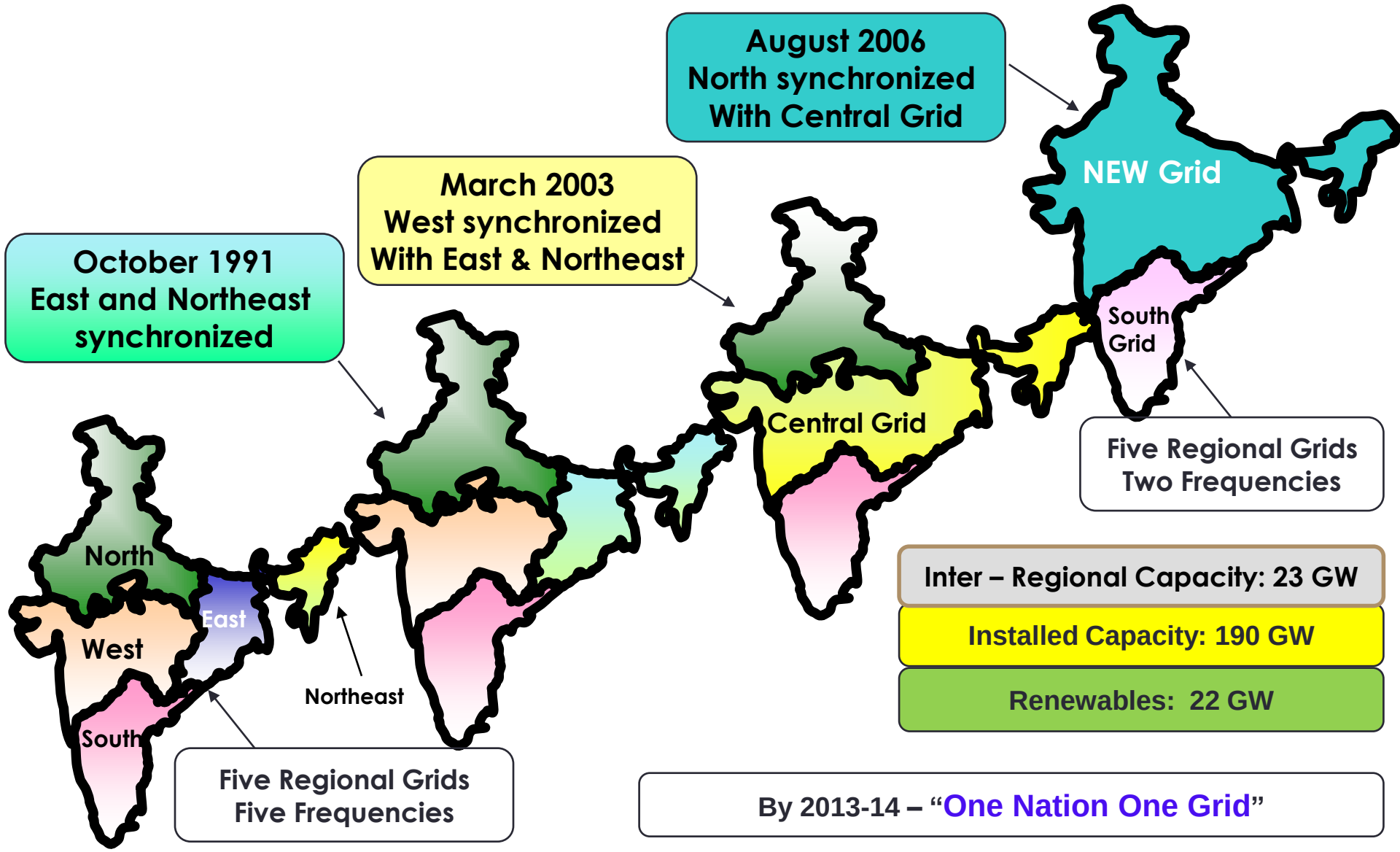
- Indian Power Transmission System.
- Evoluation of Communication Needs for Power System.
- Regulatory Provisions for Communication in Transmision.
- Communication Requirements of Up Comings Projects.
- Strategies and Plans.

INDIAN TRANSMISSION SYSTEM

Power System in India – Large Footprint

- Federal Structure - Concurrent subject
- Pressure to meet demand even in the face of acute shortages and freedom to deviate from the drawl. schedules
- Increasing stakes on grid security
- Integration of renewable energy sources
- Increasing severity of impact of nature on power system
- Regulatory compliance requirements.
- Evolving market mechanisms
- Increasing number of market participants

Evolution of Indian Transmission Grid



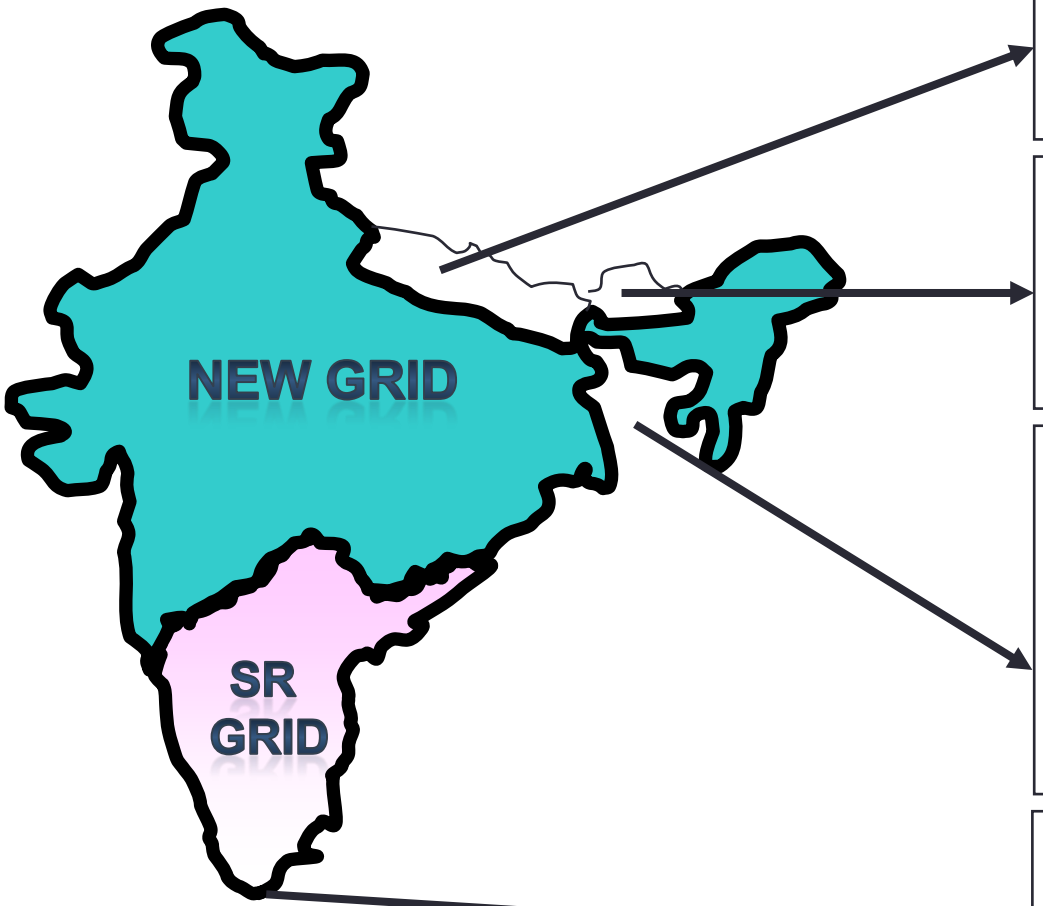
Inter – Regional Capacity: 23 GW

Installed Capacity: 190 GW

Renewables: 22 GW

By 2013-14 – "One Nation One Grid"

International Interconnections



Nepal
Over 16 links of 132/33/11 KV Radial links with Nepal

Bhutan
Tala: 1020 MW
Chukha: 336 MW
Kurichu: 60 MW

Bangladesh
(Proposed) 400 KV AC line between Baharampur(India) and Bheramara(Bangladesh) with 500 MW HVDC sub-station at Bheramara

Sri – Lanka (Proposed) Madurai(India) and Anuradhapura(Sri-Lanka) through ±500 KV HVDC under sea cable

Maps not to scale

Managing Complex Grid

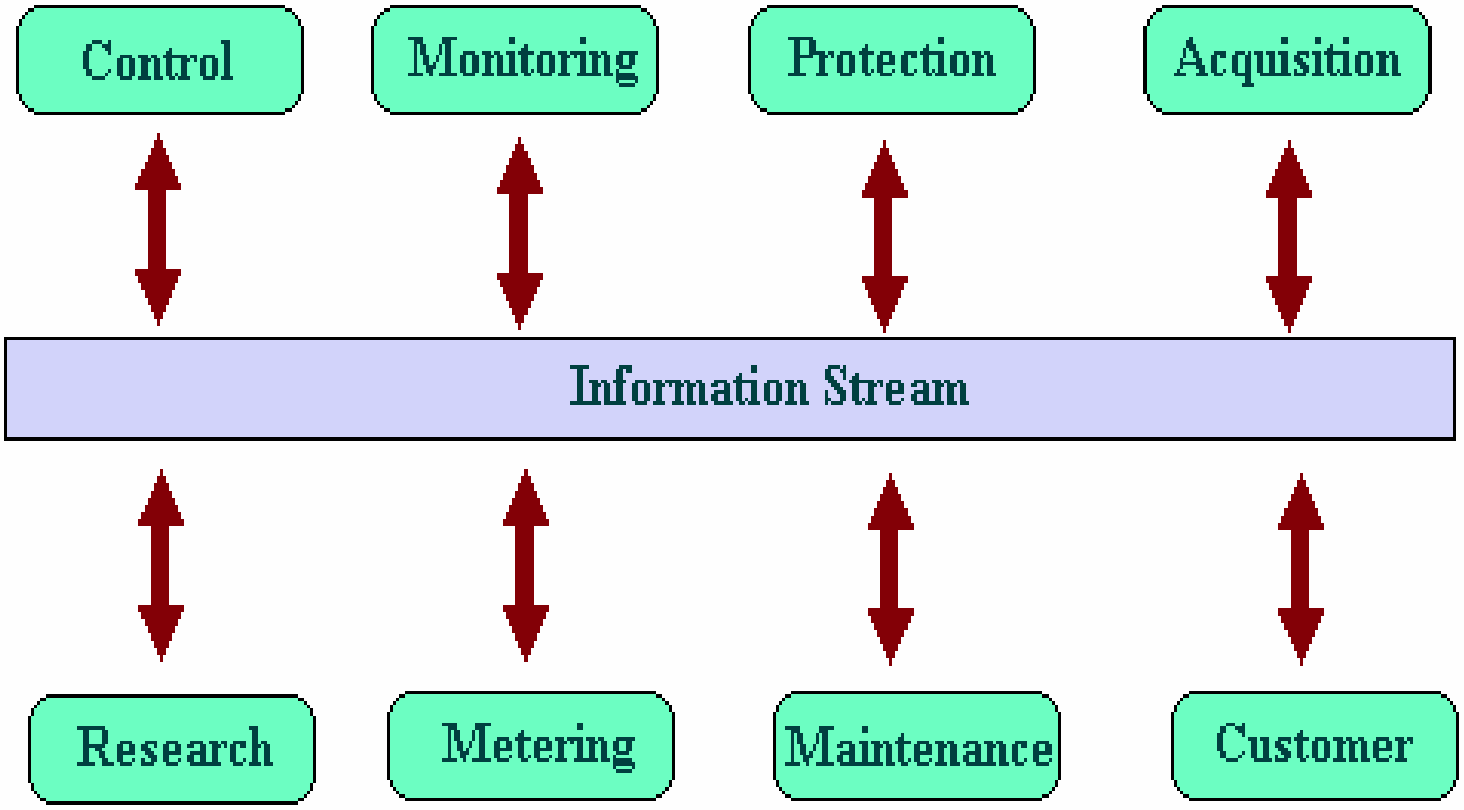
- Indian Grid is a Geographically Vast and Physically Complex network of transmission highways and switching terminus.
- It carries large power from generating centers to the load centers.
- To mange such large and complex grid, one requires:-
  - Seconds to second information on the state of the grid – Information Technology..
  - Reliable and speedy delivery of these information – Communication technology.
- Information requirements are met by innovative sensors and devices provided by modern electronics.
- Communications requirements are met by modern technologies like microwave, fiber optic etc.

EVOLUATION OF COMMUNICATION FOR POWER SYSTEM.

Evolution of Transmission Grid

- In early years - loads were fed from local generation.
- Subsequently, for reliability of power supply, generators were interconenced with tie transmission lines.
- Initially, to manage interconnected generators, ony voice communication was suffice.
- With the increase in demand, more & more elements were added leading to formation of transmission grid.
- To manage transmission grid, requirement real time data and a central control system was also felt along with voice coomunication.
- Telecom needs of power sector is increasing with the increase in the size and complexcity of the grid.

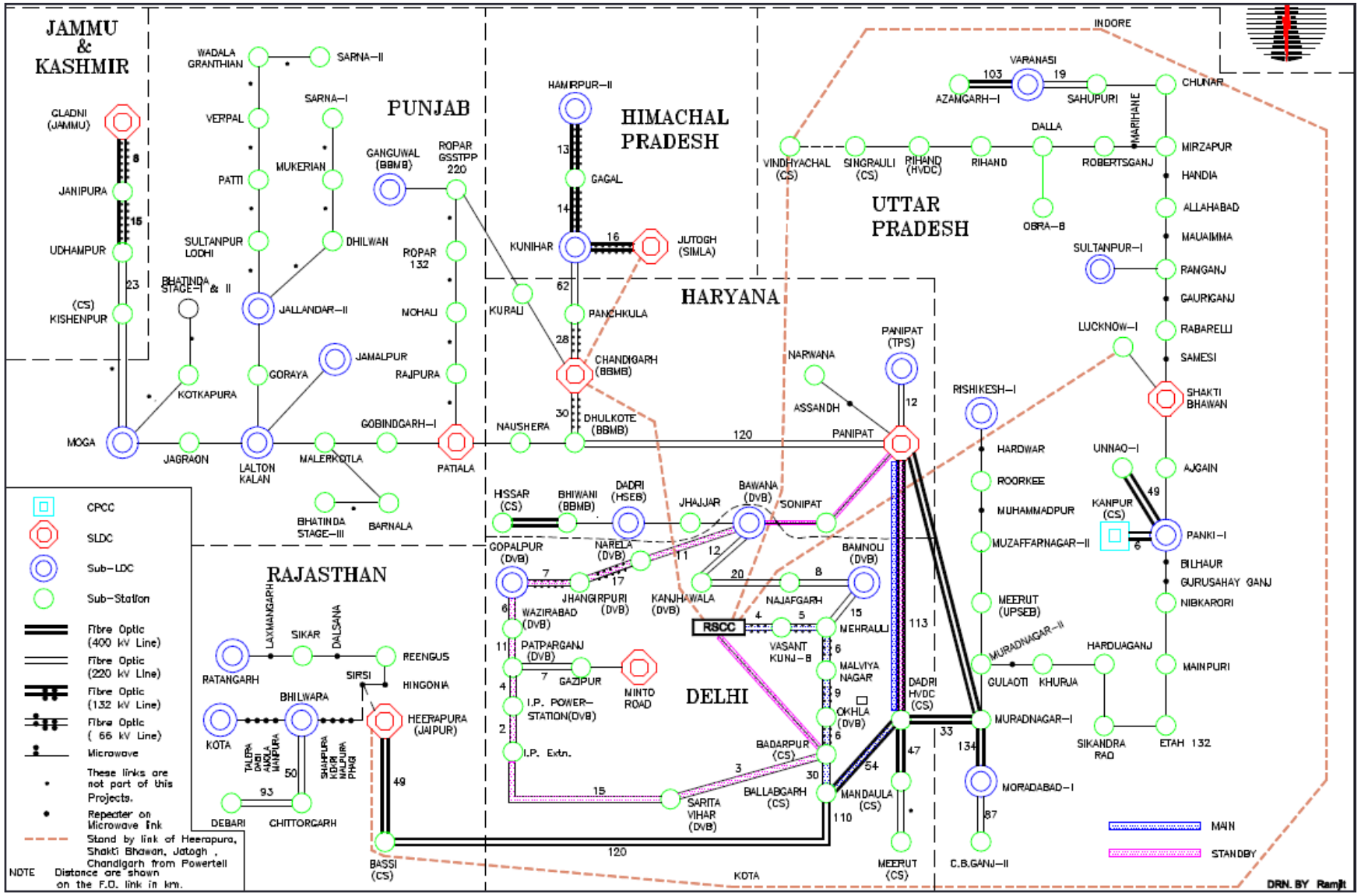
Information Needs of Power System



Communication Options

- PLCC - Power Line Carrier Communication is the oldest communication technology used for power system.
- Microwave – Is the second oldest communication system used for power system.
- Coper Wire – generally used for local area communication.
- Fiber Optic – Is the latest and most effcient communication system for modern power system aka smart grid.

Wideband Network for NR



REGULATOTRY PROVISIONS FOR COMMUNICATION IN TRANSMISION

Regulatory provisions - Data

Indian Electricity Grid Code

4.6.2 Data and Communication Facilities

"…….

- All Users, STUs and CTU shall provide Systems to telemeter power system parameter such as flow, voltage and status of switches/ transformer taps etc. in line with interface requirements and other guideline made available by RLDC.

- **The associated communication system to facilitate data flow up to appropriate data collection point on CTU's system, shall also be established by the concerned User or STU as specified by CTU in the Connection Agreement**

- ……."

Regulatory provisions - Voice

Indian Electricity Grid Code

5.2 System Security Aspects

(q) "Each User, STU, RLDC, NLDC and CTU shall provide and maintain adequate and reliable communication facility internally and with other Users/STUs /RLDC/SLDC to ensure exchange of data/information necessary to maintain reliability and security of the grid. Wherever possible, redundancy and alternate path shall be maintained for communication along important routes, e.g., SLDC to RLDC to NLDC."

COMMUNICATION NEEDS OF UP COMMING PROJECTS

Major Up-coming Projects

- National Transmission Asset Monitoring Centers (NTAMC).
- Unified Real time Dynamic Measurement System URTDSM).
- Pilot Project on Smart City/Smart Grid

NTAMC - National Transmission Asset Monitoring Center

- Aims for centralized Monitoring, Operation and Management of all POWERGRID Substations.
- Remote operation and Management of POWERGRID Transmission Assets leading to unmanned substation
- Reduction of O&M cost
- Improved Reliability

NTAMC - Architecture

- **NTAMC**: Centralized Remote operation & control (GIS S/S Gurgaon)
- **Back-up NTAMC**: Disaster Recovery for NTAMC (Yelhanka S/S, Bangalore)
- **RTAMCs**: Managing Maintenance activities & emergency operations & control - one for each region - (Location: Respective RHQ/nearby S/Stn).
- **MSHs** : Maintenance Service Hubs – Perform the maintenance activity (common for 3-4 substations) (Locations: to be finalised)

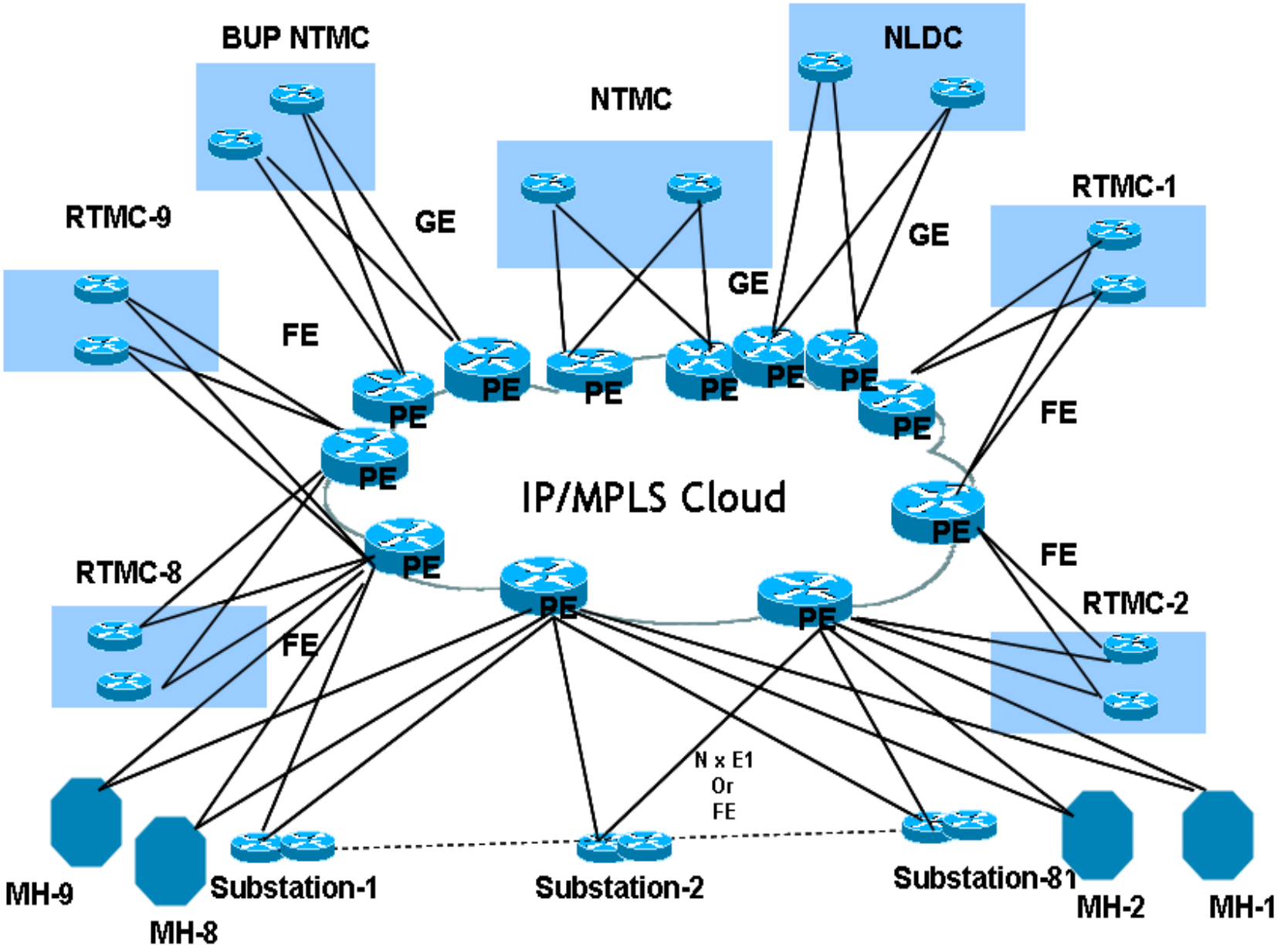
NTAMC - Communication System

- **Requirement of Bandwidth**
  - 100 Mbps between the various control centers and backbone network
  - 10 Mbps between Substations and backbone network
  - Redundancy required

- **Procurement of Bandwidth**
  - Services from POWERTEL (MPLS technology, IP/Ethernet based, VPNs)
  - Use of ULDC fibre network (up to nearest S/S having connectivity with POWERTEL)
  - Lease line from other Telecom Service Providers (up to nearest S/S having connectivity with POWERTEL)

- All the Central Sector Stations will be connected through FO network.

Proposed Network Architecture – Physical Topology

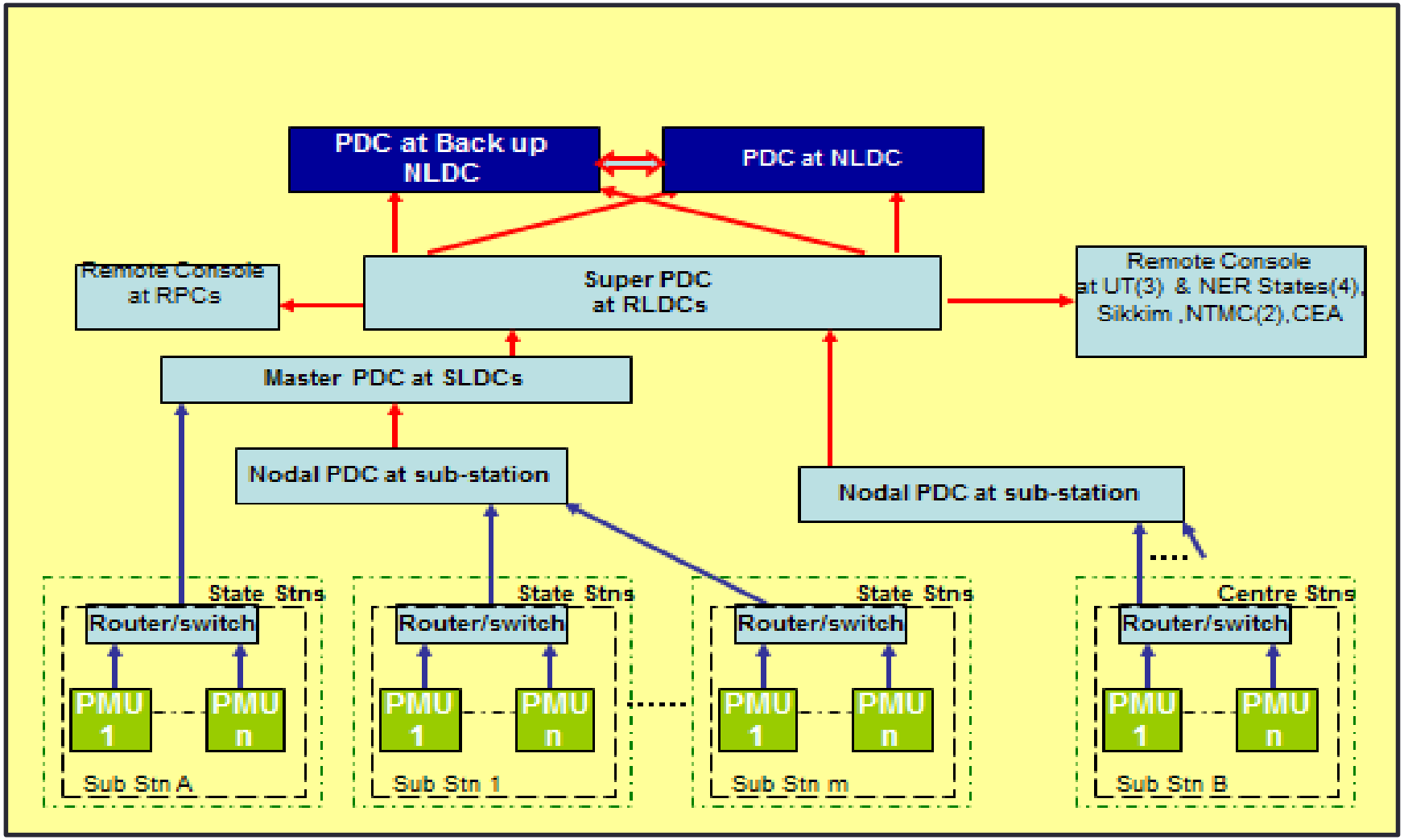


URTDSM - Unified Real Time Dynamic State Measurement

The Project addresses several questions and concerns such as:

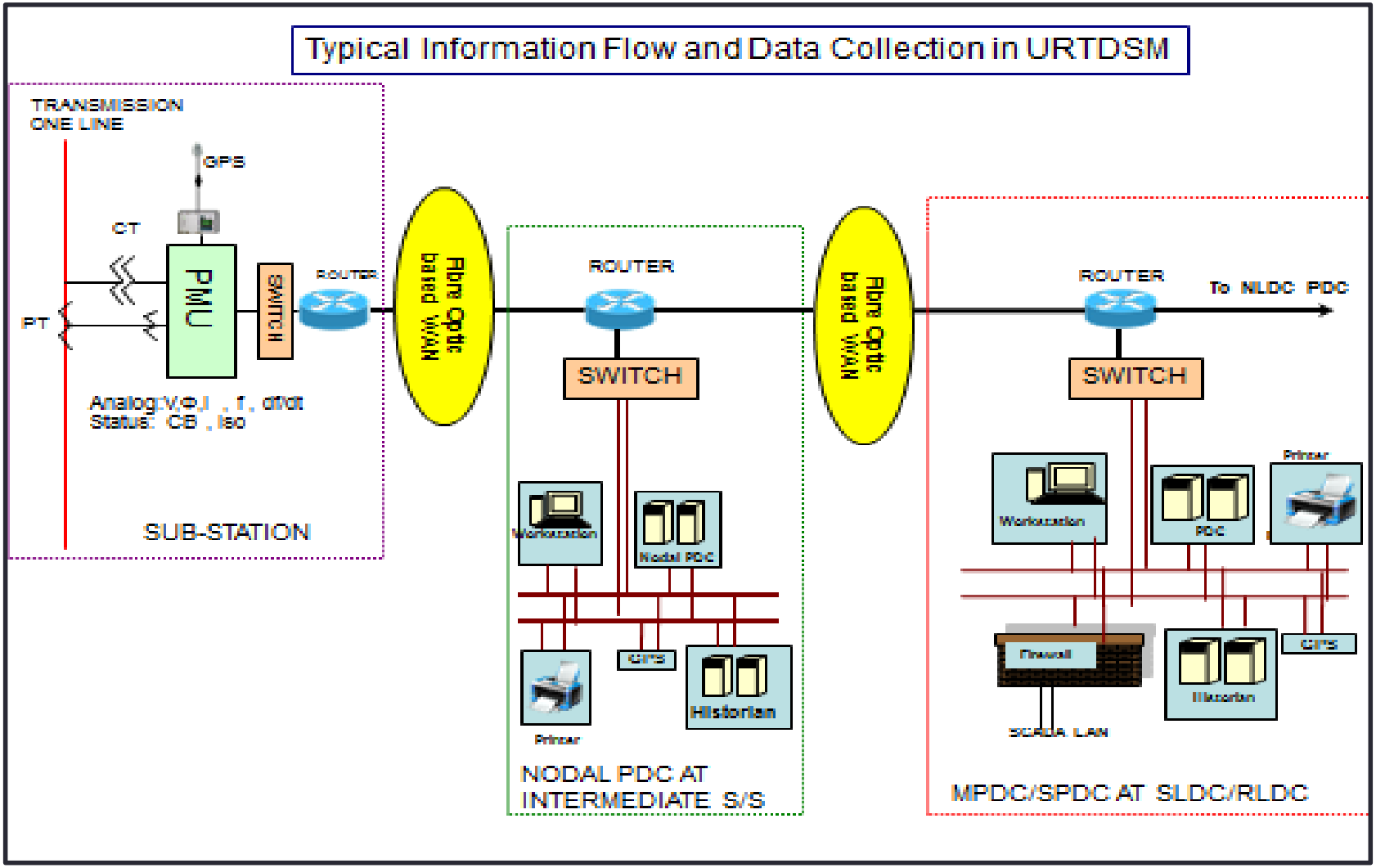
- How do we know what is going on in the grid where SCADA cannot monitor?
- Was there an Event? When, where, what kind, after-effects?
- Is the system really stressed? What are real-time margins?
- Are there unstable oscillatory modes in the system?
- What issues will arise when the percentage of Renewable Energy, an intermittent source of power, will increase to 20-30%?

URTDSM Architecture



- Total latency : about 100 ms
- Approximately 1 TB data per month from 120 PMUs

Data Flow in URTDSM

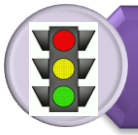


Development of Pilot Smart Grid/City

Smart Public Services for Smart City

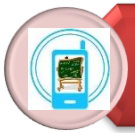

Smart Water Management


Smart Security


Smart Transport

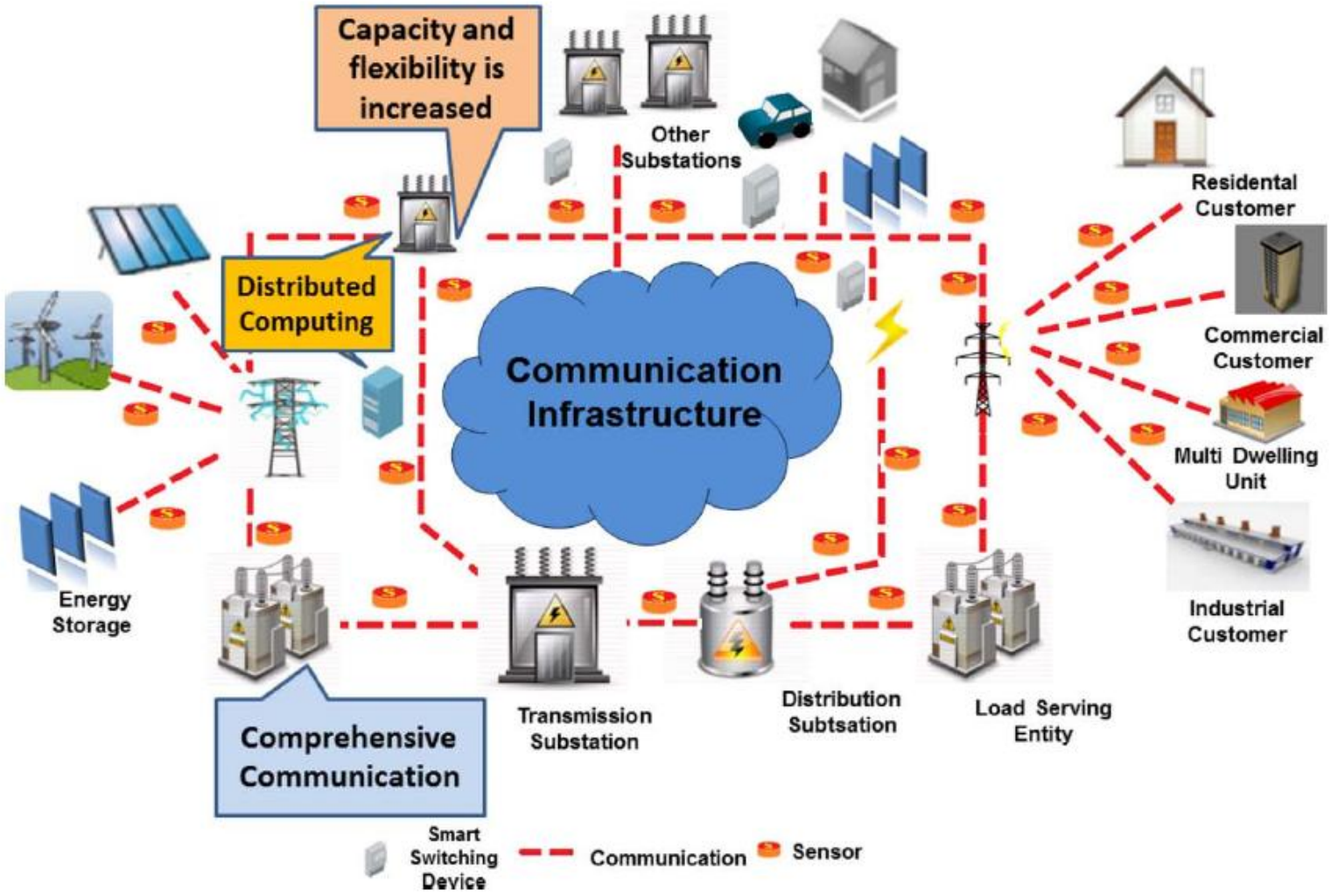

Smart Buildings & Homes


m-Governance


m-Education


m-Medical

Communication Requirement for Smart City



STRATEGIES & PLANS

Strategies and Plans

- Repelcement of microwave hops with Fibre Optic system.
- OPGW (Optical Ground Power) is to be used on transmissions lines instead of normal earth wire.
- All substations are to be connected with fiber optic communication.
- 25,000 Kms OPGW is existing and in-use.
- 20,000 Kms OPGW is being installed for replacing MW.
- 20,000 Kms OPGW is planned for connecting sub stations.
- 10,000 Kms planned under Phase-II of URTDSM project.

THANKS