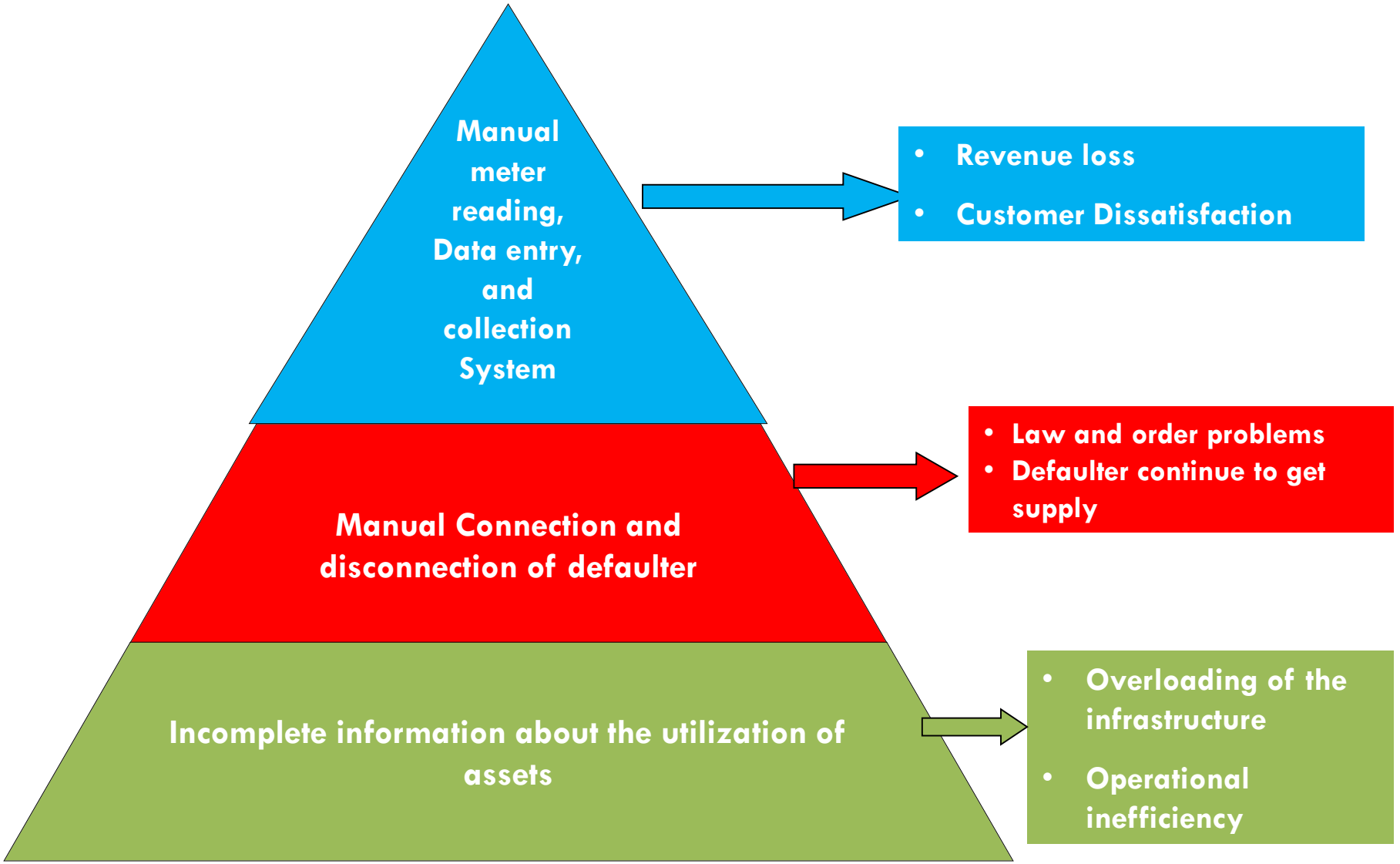
Case Study: Smart Grid In Indian Utilities

June 5th, 2017

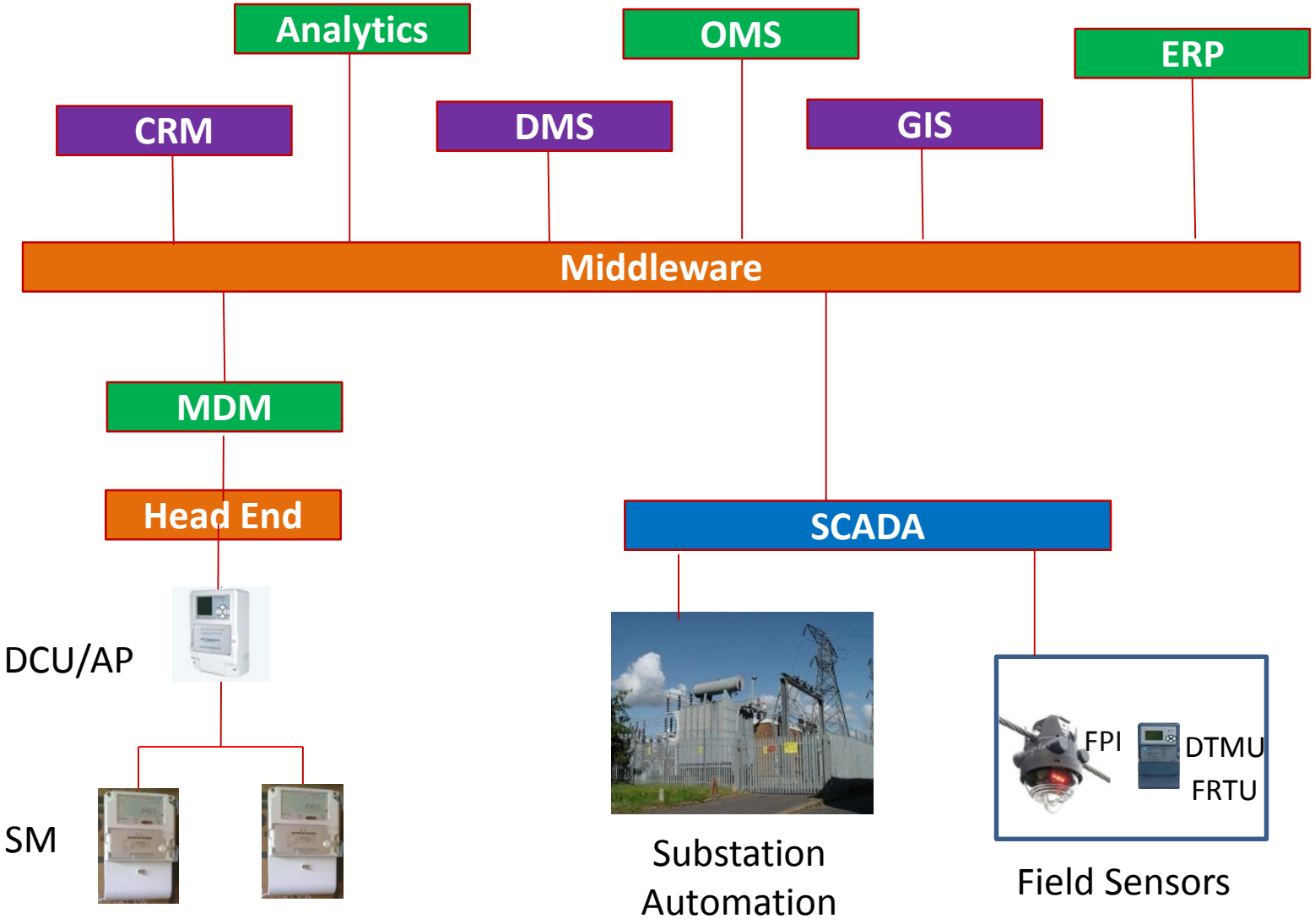
Agenda

- Issues in utilities
- Solution
- Placement of sensors and communication
- Data analytics
- Process Change
- Benefits
- Capacity Building
- Challenges
- Enabling Measures
- Way Forward

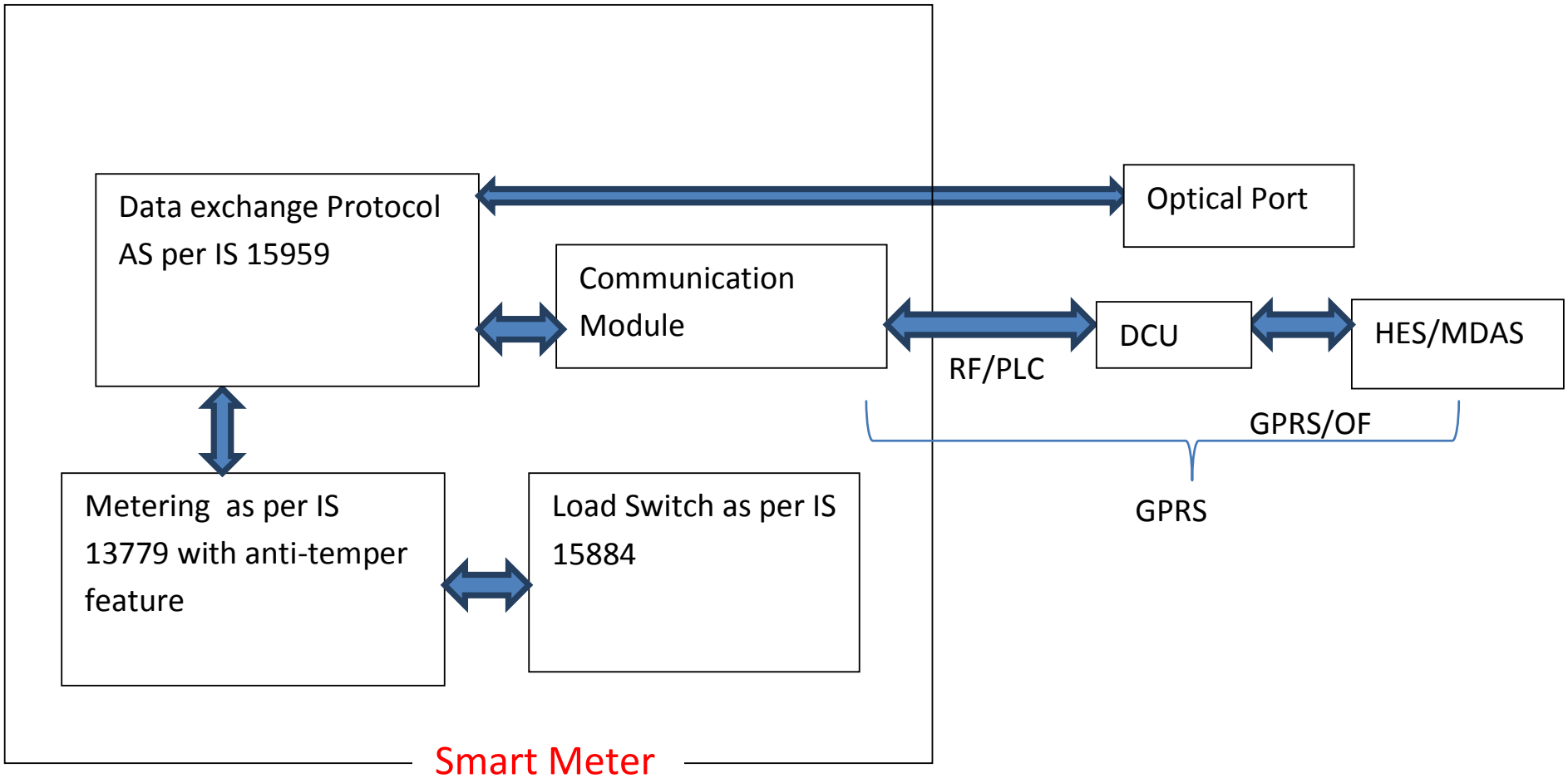
Issues in Utility



Solution Architecture



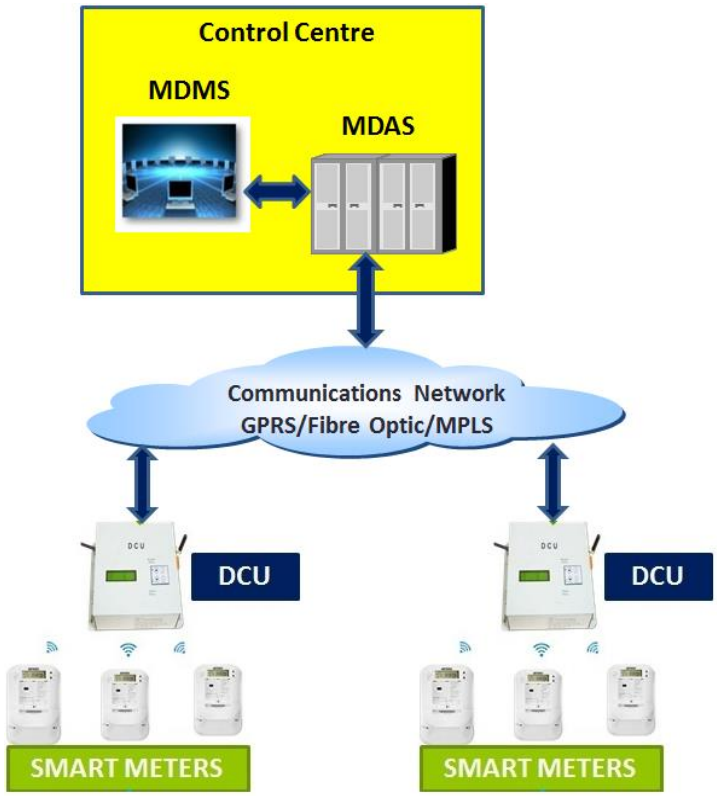
Solution – Smart meter architecture



Indian Standard 16444

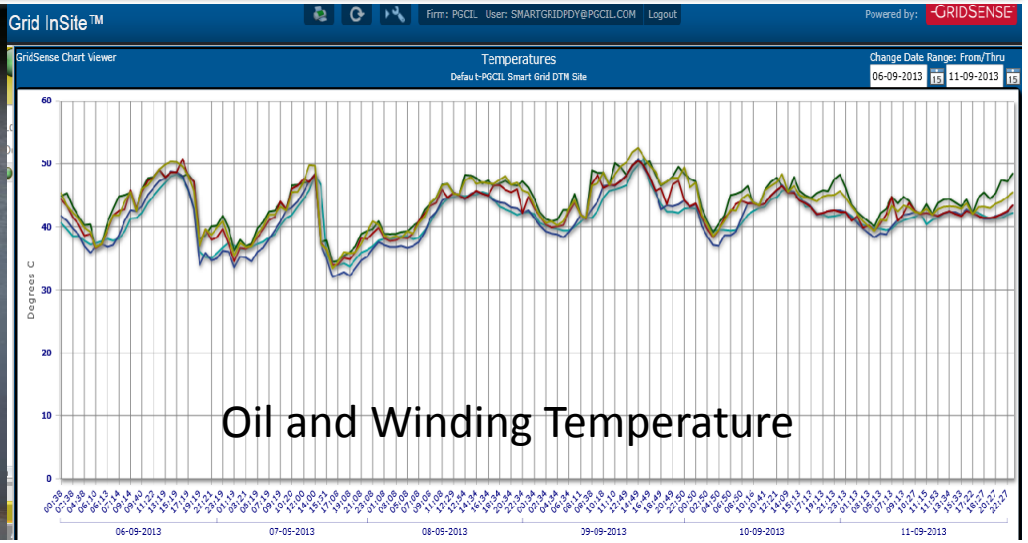
Solution – Advanced Metering Infrastructure

- Smart Meters connected to the control centre via a DCU. Facilitates real time:
  - Load curtailment – load switch in meter
  - Tamper alert
  - Push / pull of energy usage information
  - Remote firmware upgrade
- Smart Meters communicate to control centre using:
  - RF (free band 865-867MHz & 2.4 GHz)
  - PLC
  - GPRS

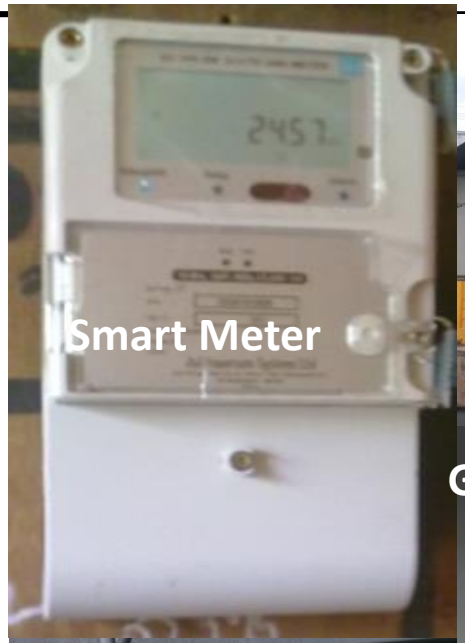


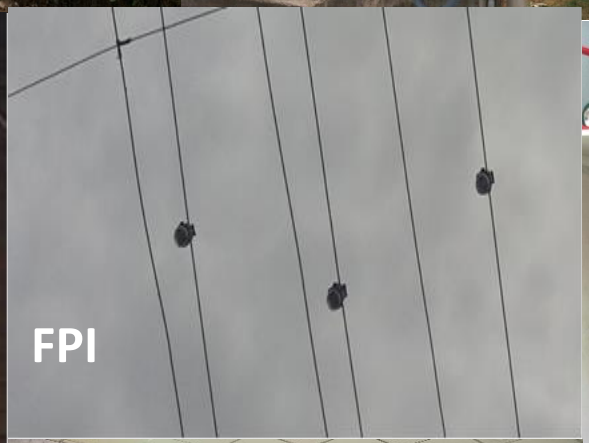
Solution – OMS

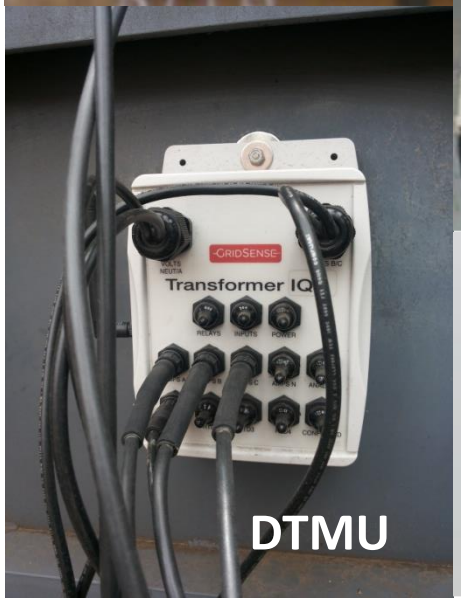
- ✓ Distribution Transformer Monitoring Systems (DTMS) installed to monitor healthiness of the DTs
  - Oil temperature
  - Oil level
  - Winding Temperature
- ✓ Fault Passage Indicators (FPIs) (communicable / non-communicable) have been installed, receiving alerts at SGCC as well as mobile phones of maintenance crew



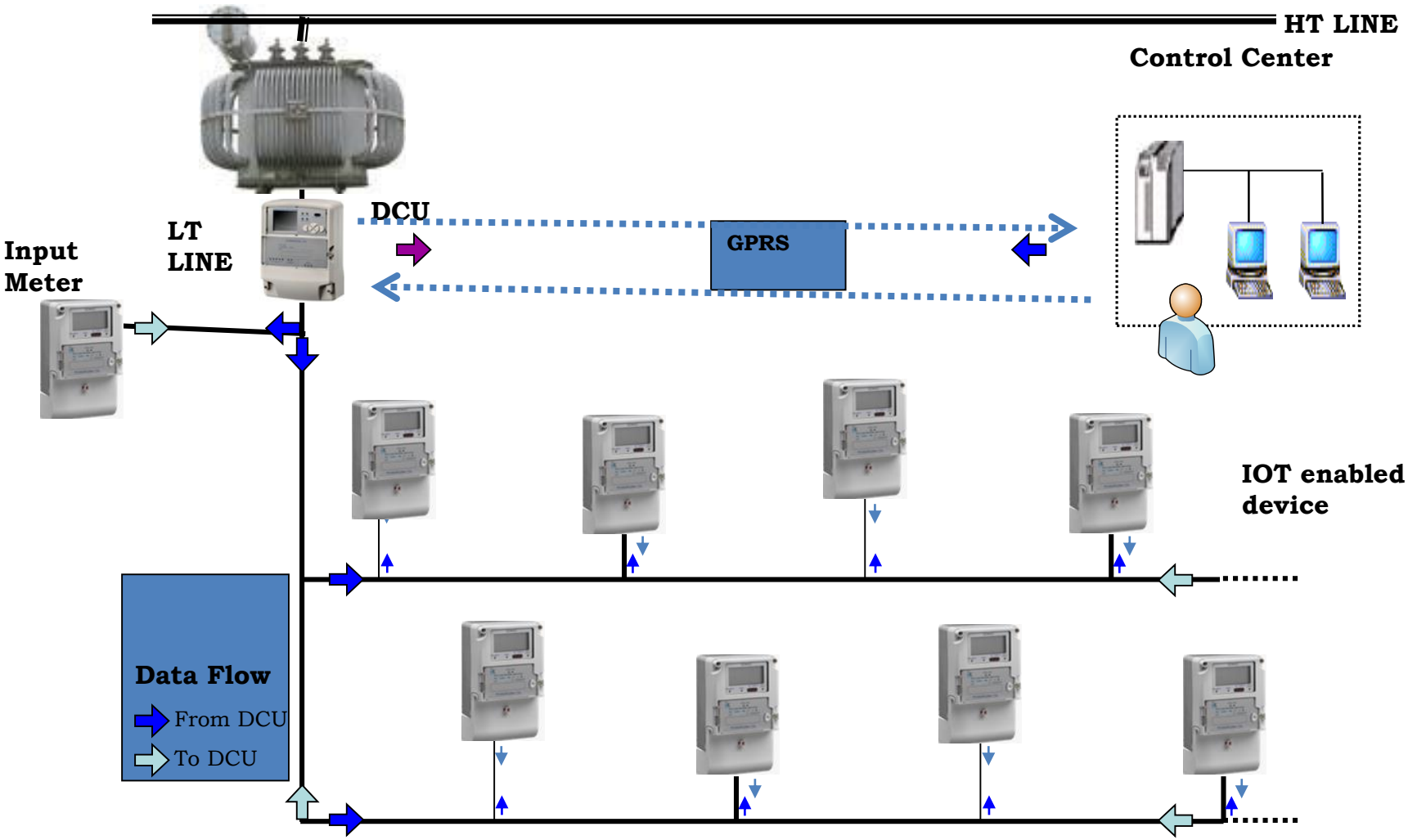
Solution – Snapshot of Installation





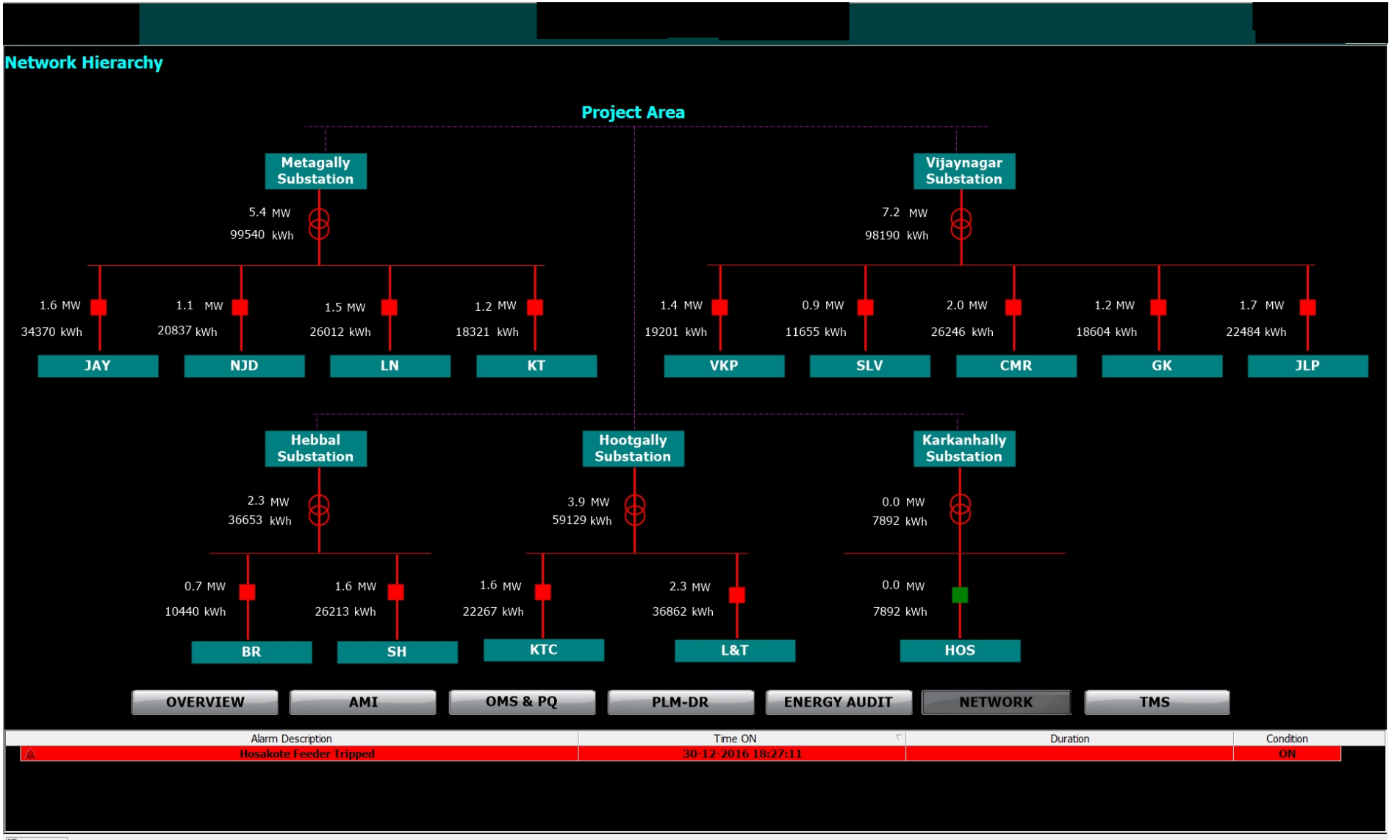


Placement of sensors and Communication



Data Analytics

Data Analytics



Data Analytics

Process Change

- Billing Through Automatic Remote metering
- Better asset utilization – DT augmentation upward as well as downward
- Realistic up gradation of consumer sanctioned load
- Remote load connection disconnection
- Redeployment of meter reader

Benefit to Utility

- Reduction of AT&C losses
  - ✓ Metering Efficiency increased by 14% through smart meter in one of the pilot location
- Online energy accounting & auditing, tamper detection and system load analysis
  - ✓ Online Energy Audit was conducted at distribution transformer level.
  - ✓ Better understanding of system load profile to design DR programs
- Improved Load Management
  - ✓ Optimal utilization of assets –deferment of capacity addition
  - ✓ Avoidance of blackouts & purchase of expensive peak power
- Improved Power Quality of supply
  - ✓ Average hourly power factor per day after VAR compensation: 0.99
  - ✓ Harmonic suppression

Benefit to Utility

- Reduced outage time & frequency
  - ✓ Increased revenue
  - ✓ Improved quality and reliability of supply
- Crew and asset management
  - ✓ Faster Identification of fault
  - ✓ Speedy power supply restoration
  - ✓ Improved asset quality & life by remote monitoring of health & undertaking preventive maintenance
- Street light automation
  - ✓ About 57% saving in energy consumption in one of the pilot location
- Renewable Integration & Net Metering
  - ✓ Facilitate penetration of renewable energy in the grid
  - ✓ Net Zero energy: Facilitation for *prosumers* to inject renewable energy back to grid

Benefit to Consumers

- Consumer Engagement & empowerment with greater control over their energy use and bill
- Improved quality & reliability of power supply
- Increased life of appliances and gadgets due to improved power quality
- No investment in power backup solutions like inverters and Gensets
- Rooftop renewable generation with facility to feed excess power into the grid – Net Metering
- Improvement in overall consumer satisfaction

Capacity Building

Delegates from the following organizations visited the pilot project:

CESU, Odisha	TSSPDCL, Hyderabad	Asian Development bank
UGVCL, Gujarat	APSPDCL, Tirupati	CRISIL
BESCOM, Bengaluru	MoP, GoI	NIT Goa
GUVNL, Gujarat	MNRE, GoI	NIWE, Chennai
UHBVNL, Haryana	CEA	GERMI, Gandhi Nagar
WBSEDCL, West Bengal	CERC	University of Malaya, Kuala Lampur
APDCL, Assam	BERC, Bihar	ENEL, Italy
TSECL, Tripura	KERC, Karnataka	SCS Consulting, USA
HPSEBL, Himachal Pradesh	OERC, Odisha	IEEE, USA
TANGEDCO, Tamil Nadu	Planning Commission	French Development Agency (AFD)
Andaman & Nicobar Electricity Deptt.	NITI AYOG	Syracuse University, New York
MSPDCL, Manipur	NSGM	USAID

Challenges

- Drafting of specification as per prevailing utility practice
- Getting the BIS marked smart meter
- Selection of communication architecture
- Interoperability
- Type testing of Meter
- Placement of DCU
- Consumer resistance
- Dynamic Nature of Distribution Network
- GPRS Signal
- Integration with Existing R-APDRP system
- Regulatory Issues

Enabling Measures

- AMI functional specification released by CEA
- Standard for Smart Meter: IS 16444
- Standard for Communication: IS 15959 Part II
- Four NABL labs are ready for testing as per IS 16444
- Sufficient no. of manufacturers are available for smart meters

Way Forward

- Mass Roll out
- Development of strong policy framework
- Development of enabling Regulation
- More consumer awareness program
- Development of self sustainable business model

Thank You

Hemendra Agrawal
DGM, Smart Grid
Power Grid Corporation of India Limited
hem@powergridindia.com