Experiences of CESC in Smart Grid Initiatives – LT Network Automation

Anjan Mitra / Arka Ghosh
✓ About 120 year old fully Integrated Energy Utility
  ❖ Oldest private electricity utility in India
  ❖ Brought thermal power in India
✓ Coal Mining – Generation – Distribution
✓ Licensed Area: 567 sq.km serving twin cities of Kolkata, Howrah & suburbs
✓ 3.0 million consumers
✓ T&D network around 19,500 ckt. km
✓ Maximum Demand: 2042 MW
✓ AT&C Loss is one of the lowest in India
Transmission and Distribution Network

“Transmission SCADA”
All 220/132/33 kV Substations are Automated
1108 Protective Relays Communicated Remotely, 14 Disturbance Recorders

“Distribution SCADA”
85% of 11/6 kV Distribution Stations are Automated

“RMU Automation”
50% of all RMUs to be automated

“DTs”
8014

“RMUs”
5100+

1x220 kV Import Point: SETCL
3 CESC Gen Stns

5 x 132 kV Import Points: SETCL

132 kV

220 kV

11 kV

220 kV

400/230 V MV/LV

“Substations”
22 Nos

“Distribution Stations”
108 Nos

Subhasgram PGCIL
400 kV

Haldia
2x300 MW

“LT Network Automation”
Based on consumer sensitivity
The LV network forms the last mile network connectivity for an overwhelming majority of our consumers.

LV network topology: Open ring main with single point neutral earthing.
Challenges in LT Network

- The LV network was a relatively neglected domain until recently.
- In the year 2011-2012, the organisation shifted its focus to LV distribution network.
- The major pain points faced in LT network are:
  - Distributed nature of the network and poor network visibility.
  - High frequency of supply outages due to Fusing and Faults.
  - Existence of Low Voltage Pockets
  - Paucity of space for installation of network assets.
  - High turn around time for sensitive LV consumers.
- These pain points, coupled with the organisational urge to ensure that our consumers have access to better quality of power at cheaper costs motivated us to revisit our traditional practices pertaining to LV distribution network.
LT Network Automation

- LT Auto-change-over System
- LT Pillar Box with MFM
- Consumer end Power Fail Indicator

GIS-centric LT Control Room
Field Force equipped with Tabs

Call Centre with LT Outage Details
GIS based LT Outage Management

over SMS
over OFC
Objectives of LT Network Automation

- Less Outage Duration in LT Network
- Constant Supply Monitoring of Important Consumers
- Energy Audit Operations
- Loss Control Measures
- Supply Monitoring during important events and festivals
<table>
<thead>
<tr>
<th>Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart Re-Engineered Pillar Boxes</td>
</tr>
<tr>
<td>Smart Pillar Box Automation</td>
</tr>
<tr>
<td>LT Power Failure Indicator</td>
</tr>
<tr>
<td>LT Compact Substations</td>
</tr>
<tr>
<td>Smart LT Auto-Changeover Systems</td>
</tr>
<tr>
<td>Crew Management for Field-force automation</td>
</tr>
</tbody>
</table>
Problems Faced in Conventional Pillar Boxes:
• Protection: No. 14 SWG Copper wire
• High frequency of fusing
• Rewireable copper fuses prone to failure due to ageing.
• Fusing current a function of Skill of workmen.
• Live line Operation: Safety Hazard

Re-engineered Pillar Boxes:
• Compact design: Operation only from the front.
• HRC fuses in place of rewireable fuse wires.
• Better reliability of supply
• Fuse replacement does not require skill.
• HRC fuses ensures safety in operation
• Nearly 11200 Pillar Boxes installed till date
Pillar Box Automation

- Installation of Automation Unit in Re-engineered Pillar Box.
- Proactive information in case of Fusing through SMS alerts.
- Pinpointed information of Fusing.
- Faster restoration of supply in case of outage.
- Reduction in Process Cycle Time.

Remote monitoring of Pillar Boxes

- CTs installed on cable cores.
- Electrical Parameters transmitted to remote control centre through RTUs via Fibre Network
- Proactive remedial action.
- Pilot project done for pillar boxes supplying to major Durga Puja pandals in Kolkata

Automated Pillar box
SMART Pillar Box Automation

Pillar Box \(\rightarrow\) MFM Box \(\rightarrow\) FRTU \(\rightarrow\) RMU

CTs, Ph-Volts \(\rightarrow\) Modbus \(\rightarrow\) I/O s

IEC 60870-5-104

O/F Network

Existing RMU Automation System

CSC Limited
SMS to GUI Conversion Scheme
Pains associated with Low Voltage Pockets

- Low Voltage pockets crop up in our distribution network mainly due to Overloaded Transformers, Long Distributors and High Concentration of Reactive Loads.
- Pockets are eliminated by CAPEX intensive processes of LV network remodelling and commissioning of new transformers.
- Traditional methods make little economic sense for smaller pockets.

The way out: LTCSS

- LTCSS comprises of a Voltage Regulator and a capacitor bank, installed individually or in a combination at strategic points.
- It is an Autotransformer, in conjugation with a capacitor bank to compensate internal reactive power requirement.
- Suited for low voltages due to long length of distributor.
- Capacitor banks are also installed in areas with Reactive loads which reduces line losses by modulating the reactive current.
Aimed at reduction of turnaround time for supply failure for sensitive LV consumers.

Two feeds are kept ready at supply point for automatic changeover from one to the other in case of supply failure.

The two feeds are obtained from different MV sources, which are fed from separate power transformers.

Practically Uninterrupted supply & increased customer satisfaction.

Also as the supply is being changed over SMS alerts are generated and sent to predefined mobiles.
Crew management in managing customer complaints

- Aimed at reducing the movement of front end personnel
- Front end personnel supplied with APPs loaded smart phones enabling acceptance of customer complaints and providing feedback on the go.
- Reduction of Process Cycle time.
- Minimisation of Error due to manual intervention in the process.
Benefits

- Technical Loss Minimisation
- Enhanced Customer satisfaction
- Improved Network Performance
- Cost Savings
Roadmap of LT Network Automation

- Large-scale rollout of LT Pillar Box Automation in the coming fiscals.
- LT Voltage Imbalance Auto Correction Techniques
- Smart Metering (AMI) of a large section of the consumer base in Kolkata city
- Need based deployment of LT Power Failure Indicator & Smart Auto Changeovers
“THANK YOU”