Smart Grid in Distribution System

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India's first fully integrated electrical utility, generating and distributing electrical power in Kolkata and Howrah since 1899.

Licensed Area: 567 Sq Kms

Generation Capacity: 1125 MW

Units Input (FY 18-19): 10800 MU

System Met: 2312 MW (recent)

HT Consumers: 1800
LT Consumers: 3.2 Million
Distribution Network

As on 31-3-2019

132kV Import Points: WBSETCL - 5

3 CESC Gen Stns

220kV Import Points: WBSETCL - 1

132kV

220kV

33 kV

11 kV

6 kV

Substations

17 Nos

“Distribution Stations”

116 Nos

Subhasgram

PGCIL

400 kV

Haldia

2x300 MW

DTs

8526

RMUs

5000+

400 /230 V

MV / LV

Generating Station

Installed Capacity

Budge Budge

750 MW

Southern

135 MW

Titagarh

240 MW

TOTAL

1125 MW

Haldia

600 MW

Distribution Assets

As on 31-3-14

Substation Capacity

3027 MVA

Distribution Station Capacity

3972 MVA

Distribution Transformer Capacity

2853 MVA

Lines: 220 kV, 132kV

658 ckm

Lines: 33 kV

1666 ckm

Lines: 11 kV & 6 kV

6881 ckm

MVAC Lines

13359 ckm
Energy flow diagram of CESC System

- **Import**
  - 220/132kV BUS
  - 132/33kV Transformer
  - 33kV BUS
  - Sale at 33kV

- **BBGS SO**
  - 220/132kV BUS
  - 132/33kV Transformer
  - SGS SO
  - Persons other than own cons

- **Energy delivered into 33 kV Distribution System**
  - 33/20/11,6kV Transformer
  - 20, 11, 6, 3.3kV NETWORK
  - Sale at 20,11,6,3.3kV

- **Sale at LV**
  - 11,6/0.4kV Transformer
  - L. V. BUS
  - Sale at LV
33kV Ring Main Cluster Network
Communications over Optical Fibres to these locations

220 kV M/C Tower  132/33 kV S/S  132 kV GIS  33/11 - 6 kV Transformers

Communications over Wireless for these locations

33 kV GIS  6 kV AIS  RMU  DT  Meters
SCADA/EMS/DMS Systems
SCADA/EMS for EHV system; SCADA/DMS for HT distribution system; all Distribution Stations (116) are fitted with State-of-the-art SCADA System

Telecommunication infrastructure
OF/GPRS; RF installed; Technology trial done for PLC and Wifi

Feeder (RMU) Automation – OF based, wireless
470 nos. fully automated; 85 nos. semi automated

AMR/AMI
All HT and high value LT consumers are on AMR (> 10,000); AMI infrastructure installed Meters installed 10,000 3000 Smart Meters on cellular

All DTRs are on AMR
All electrical parameters are stored and linked on GIS map

Street lights on AMR and Controller
14700 street light services on smart street light management system

GIS & GPS integrated consumer complaint management system

More than 27 MW Solar PV Plants integrated with system under Net Metering arrangement

Pilot (1.5 MW) Auto Demand Response Program implemented
CESC Smart Grid Drivers

• Reduction of distribution losses
• Stable 24x7 power supply to all categories of consumers
• Improvement in Power Quality
• Peak load management
• Reduction of infrastructure costs
• Reduction in O&M costs
• Reduction in power purchase cost
• Readiness for ToU (Time of Use) Tariff
• Energy Efficiency Programs
• Renewable integration
• EV penetration
• Storage accommodation
• Technology Adaptation
• Training & Capacity Building
• Customer Outreach & Participation
• Sustainability Initiatives & Public Safety
Benefits of AMI

- Savings from cost of meter readers and support staff
- Reduction in wrong readings, premises locked situations, omissions etc.
- “Dead / defective” smart meters are now identified from remote quickly, without waiting for site inspections or consumer complaints and the billing on estimation period has shrunk
- Remote disconnection of defaulting customers will improve revenue collection and reduce receivables
- Remote surveillance on load pattern of consumers and identifying the appropriate tariff category
- Consumer indexation and energy audit being done for DTRs in the area
- Close monitoring on real-time data – proactive action is taken in case of supply outage, voltage variation, meter defects etc.

Demand Response program can be taken up using Smart Meters – but not done till date
Benefits of Distribution Automation

- 33kV network automation is done through SCADA and GIS / Switchgear installed at Substations
- RMU (6/11kV) Automation leads to faster identification, isolation and supply restoration
- Reduction in average restoration time means better customer service
  - Automation of RMU in Important installations- Hospitals, Pumping Stations, Govt. offices and other important installations - Average Restoration time is 1 min
- It provides safety to working personnel while doing switching operation in the network
- It provides network redundancy
Benefits of SCADA / EMS /DMS / OMS

- Visualisation of power system
- Real time monitoring
- Faster identification, isolation and supply restoration
- Reduction in average restoration time means better customer service
- It provides safety to working personnel while doing switching operation in the network
- Improved network planning at reduced cost
- It provides network redundancy
- Scheduling of power
- Merit based power procurement from embedded generating stations and outside
National Electricity Policy:

“Distribution is the most critical segment of the electricity business chain”

National Tariff Policy:

“Making the distribution segment of the industry efficient and solvent is the key to success of power sector reforms”
**HT Command Station**
Operating Engineer placed at HT Command Stations (5 nos.) located across licensed area engaged in round the clock operation.

**Separate desk for HT consumers**
There is separate desk at Central Control Room for communication with HT consumers.

**LT Control Room**
There are 10 districts for development and operation of LT network.
LT Control Room acts as a value added layer over the 10 Regional Reporting Centres (RRC) at districts
Monitoring of exceptional customer calls
Proactive Outage Management for critical & sensitive Installation
Monitoring of repetitive customer complaints
Ensuring faster restoration of customer calls using GPS aided ‘Vehicle Tracking’ System and Crew Management System
Monitoring supply restoration in LT faults complying with the internal benchmark (stiffer than regulatory norms)
Other initiatives

- Replacement of old Pillar Boxes with Re-wirable fuses by Pillar Boxes with HRC fuses for reduction of fusing, ensuring safety, reduction in loss
- Installation of MCB/MCCBs at consumer service points for faster restoration, ensuring safety
- Installation of Automatic Power Factor Controllers at secondary side of distribution transformers for improving voltage profile and better utilisation of DTR capacity
- Condition based Monitoring (predictive maintenance) of T&D equipment for reducing forced outages and effective utilization of asset
**Trends in Average Restoration Time**

**Average Supply Restoration Time for LT Cable Faults**

- **FY 13:** 7
- **FY 14:** 6
- **FY 15:** 5
- **FY 16:** 4
- **FY 17:** 3
- **FY 18:** 2

**Average Restoration Time for Fuse Failures**

- **FY 13:** 1.2
- **FY 14:** 1.15
- **FY 15:** 1.1
- **FY 16:** 1.05
- **FY 17:** 1
- **FY 18:** 0.95
AMR in DTR replaces manual system of load reading
- 24x7 data logging of DTR loading
- DTR load data integrated with GIS
- Load management based on real time data
- Generate exception reports
- Better asset management
- DTR Failure Rate – 0.40%

More than 50% reduction w.r.t. FY 12-13
Voltage complaints

Consumer base
29.2 lakhs 14-15
30.2 lakhs 15-16
31.2 lakhs 16-17
32.2 lakhs 17-18

More than 75% reduction w.r.t. FY 14-15
Almost all inspection are done (98%) within 3 days of application
New Activities being executed / under plan:-

- Upgradation of SCADA / EMS / DMS / OMS
- GIS with consumer indexing
- Demand Response
- EVCS – few already installed
- Storage – under study
Costs and Reliability

Cost Vs. Reliability

Total Cost

Cost of Investment

Cost of Interruption

Reliability

Costs

0.995 0.9952405 0.995409 0.9957485 0.9962475 0.996497 0.9967465 0.996996 0.9972455 0.997495 0.9977445 0.997994 0.9982435 0.998493 0.9987425 0.998992 0.9992415 0.999491 0.9997405 0.99999

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THANK YOU

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