



IT/ Technical Interventions

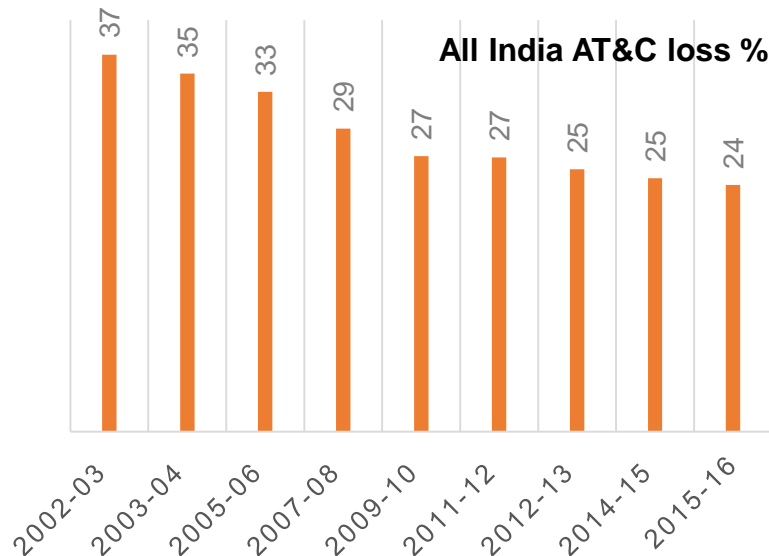
Workshop on AT&C losses
New Delhi, 19-Sep-2017



A chain is only as strong as the weakest link

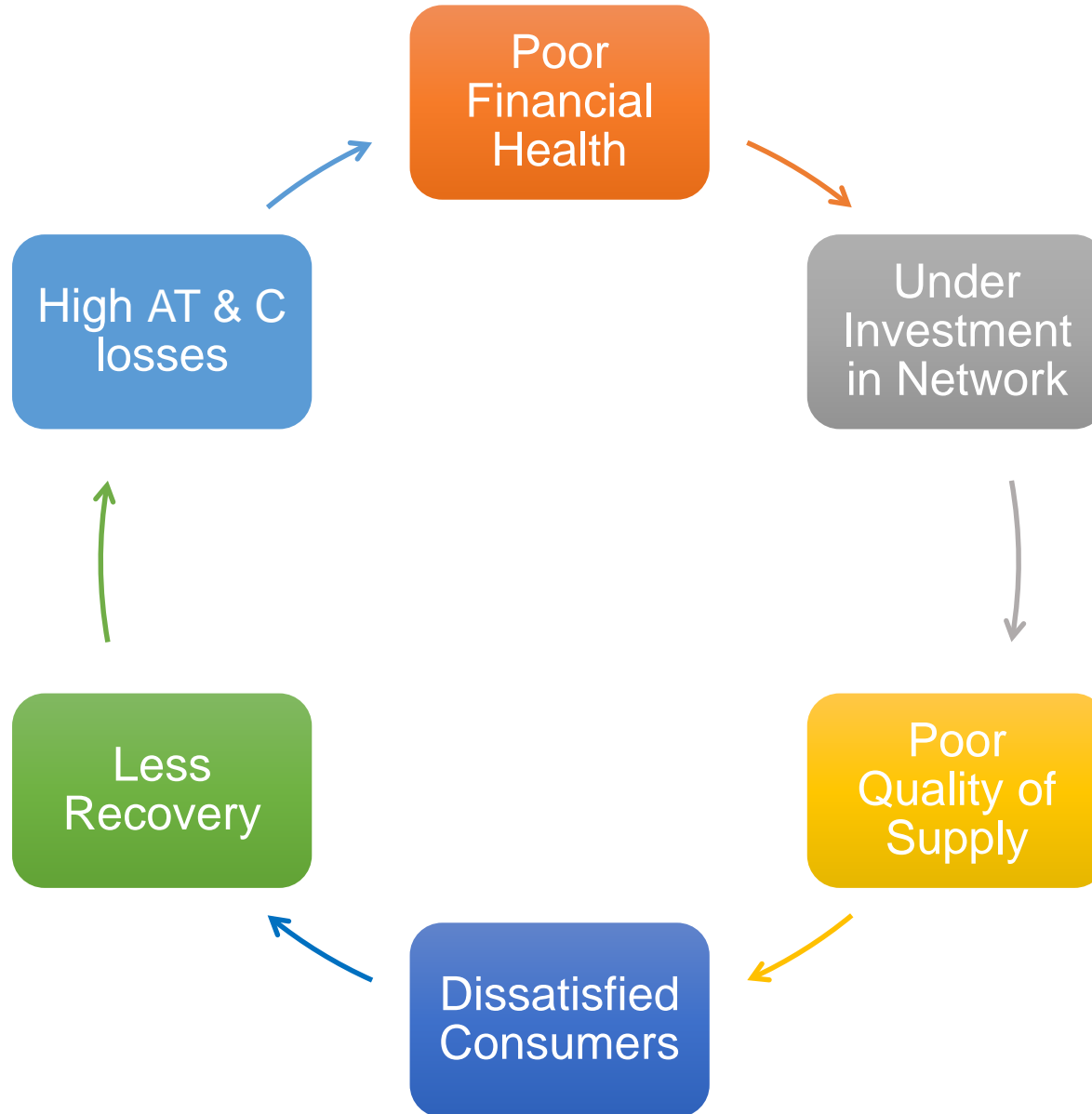
Distribution is the most vital yet the weakest link in India

- 💡 32 States/Union Territories
- 💡 60 Discoms, 10 major pvt Discoms
- 💡 Electricity customer base of ~22 cr
- 💡 AT&C loss ~ 24% (FY15-16)

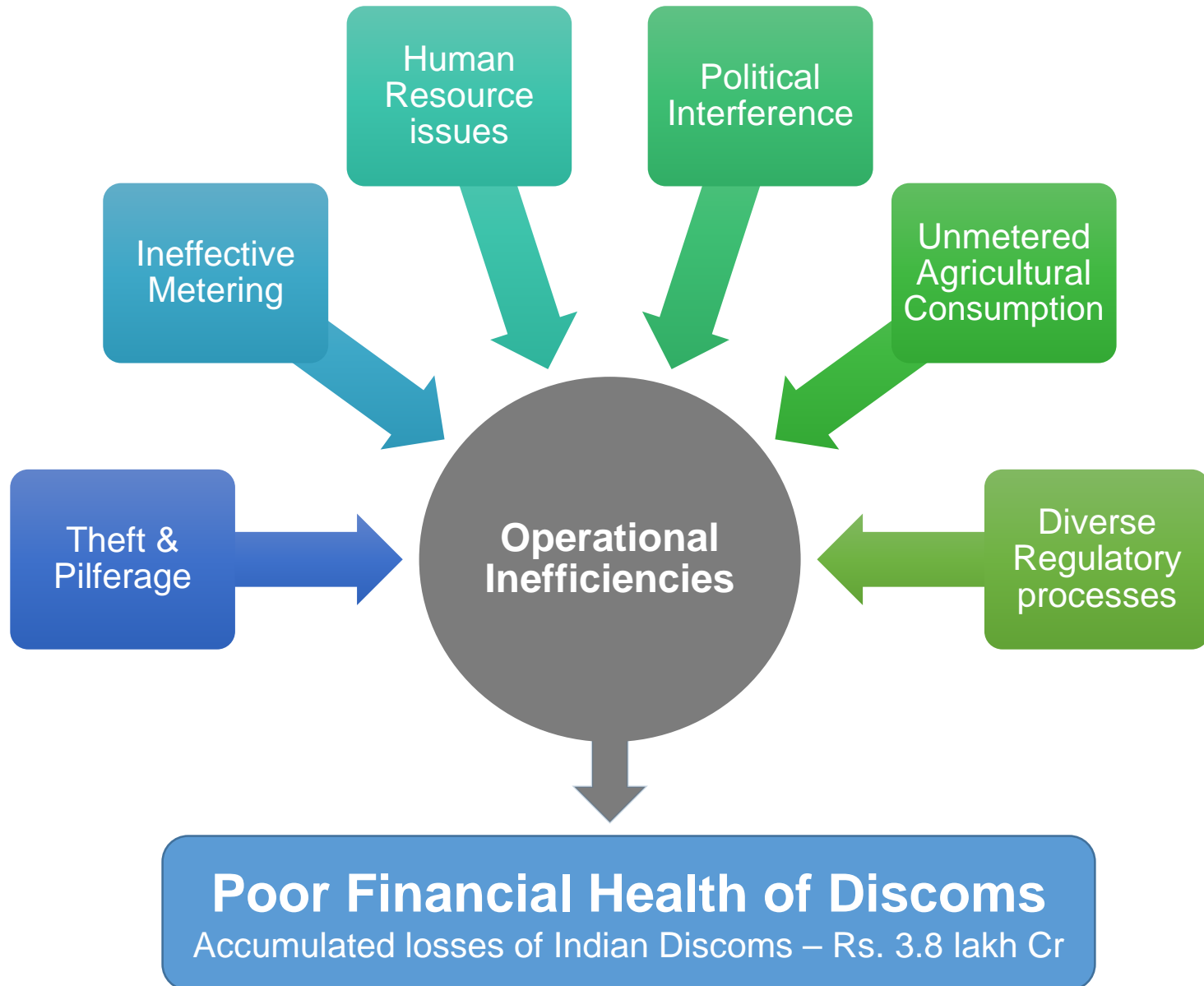


$$\text{AT\&C loss \%} = [1 - \text{Billing Efficiency} \times \text{Collection Efficiency}] \%$$

Vicious Cycle in Indian Distribution Sector



Challenges – Discoms





Government of India Initiatives

towards improvement in Operational Efficiencies



- Accelerated Power Development Programme (**APDP**) 2000-01
 - Grant for various interventions like metering and System Strengthening
- Accelerated Power Development & Reforms Programme (**APDRP**) 2002-07
 - Urban focus for entire India & introduction of reforms element
 - Incentive scheme introduced to incentivize utilities achieving loss reduction
 - Reliable data of revenue, energy still not available - **need of integrated IT solution felt**

- **Decision to leverage ICT for accurate Base line data of energy & revenue**
- **support Discoms in IT enablement of their business processes**

Committee constituted in July 07 under JS, MoP

- finalized System Requirement Specifications (SRS) Template covering IT applications for MBC, Energy Auditing, GIS, AMR for Feeder, DT & HT consumers along with IT enabled centralized Customer care centers



Government of India Initiatives

towards improvement in Operational Efficiencies



Restructured Accelerated Power Development & Reform Programme (R-APDRP) - FY 09, Rs 44000 Cr

- **IT enabled platform, Distribution Automation with different levels of communication.** Establishment of consumer service centres
- **Strengthening and up-gradation of distribution network** for reducing AT&C, increasing reliability, automation and remote control

Integrated Power Development Scheme (IPDS) - FY15, Rs 32000 Cr

- **Sub Transmission & Distribution strengthening** in urban areas
- **IT implementation** for better customer service, **ERP** for Discoms
- **Smart Metering** for large consumers
- **System & Consumer meters**
- **Rooftop solar panels**



AT & C loss reduction



Comprehensive IT Solution for Power Distribution



- Collection of energy and revenue data without human intervention
- Data center/DR Center at State level, where database and application server resides
- Development of [17 Software modules](#)
- IT infrastructure at Sub stations/Town level offices
- Secured MPLS connectivity for utility offices
- GIS based Asset mapping and Consumer indexing
- AMR for Substations, DT and HT consumers with centralized data logging
- Town/Feeder/DT level Energy Audit
- Single window Customer care center
- Development of Web portal of utility for real time customer service



IT in Power Distribution Sector under IPDS



- IT enablement taken up in 1405 towns under R-APDRP, 1356 towns declared Go-Live
- Establishment of IT Backbone - 20 Data Centers, 20 Disaster Recovery Centers and 40 Customer Care Centers for Urban Power Distribution
- Scope of IT enablement extended further in about 2600 towns to cover all Urban area in the country
- **Energy Audit module** collects data from MBC and MDAS module and use Consumer Indexing and Asset mapping database for deriving Energy consumption
- Tools provided during IT enablement help Discoms to -
 - Take measures for reduction of AT&C losses by way of proper and accurate Energy Accounting at various system levels
 - Improve Consumer satisfaction
 - Monitor all 11 KV Feeders through National Power portal
 - Improve financial viability of DISCOMs

Monitoring of operational performance through Post Go-Live reports, Feeder Monitoring on NPP



Administrative measures to reduce Commercial Losses



- IT system has capability to assist utilities in identifying revenue leakages by identifying loss pockets with each DT/feeder and further deficiency in system operation, if any
- Strict administrative measures to be initiated by utility to improve billing & collection leading to reduction in AT&C losses. A few action points are:
 - **Administrative Actions-**
 - Regular analysis of exceptions from EA reports
 - Metering of unmetered consumers and replacement of faulty meters, CTs/PTs
 - Cycle time for billing and collection be reduced
 - Operationalization of feeder manager system
 - More payment channels to improve customer convenience
 - Organize awareness drives
 - Impose strict vigilance in theft prone area



Measures to reduce Technical Losses



• Technical Actions-

- Phase wise load balancing
- De-augmentation of DTR having less than 30% utilization
- Diverting load from overloaded DTR having more than 80-90% loading
- Capacitor placement
- Feeder bifurcation, reconfiguration/reconductoring for overloaded feeders
- Sub-station and DT R&M
- LT Aerial Bunched cable in theft prone area etc.



Metering



Prepaid Metering

- **Benefits:** Enhanced utility revenue, theft avoidance; bad debt reduction; no cost towards meter reading & billing; advance demand planning and disconnect/re-connect costs reduction
- Regulators to make enabling provisions for utility to encourage pre-paid metering system
- ~2 lac Prepaid meters sanctioned under IPDS for Govt. Establishments

Smart Metering

- Indian Standard IS 16444 for Smart Meter specification and IS 15959 for communication protocols finalized
- Functional Requirements of AMI In India finalized by CEA in Aug. 2016, including Technical specifications of smart meters and communication protocols as per BIS
- Strategy for roll out of Advance Metering Infrastructure in the States/UTs issued by CEA to all the States in Aug. 2016.
- ~ 2.50 Lakh AMI/Smart meters sanctioned under IPDS



Other relevant interventions by Gol



- MoP/PFC is facilitating States to reduce AT&C loss through **problem-solving** and **sharing best practices** *inter alia* including following:
 - Issue of advisories, technical specifications, SBDs
 - Capacity Building of utility personnel on contemporary areas
 - Metering related -
 - Co-ordination with Meter manufacturers for integration of their legacy meters
 - Finalisation of Downloadable/Open protocol/AMR Meter standards with BIS
 - Setting up of Meter Testing Lab with CPRI
 - GIS Indexing related -
 - Towns GIS Maps procurement streamlined with NRSC
 - GIS validation/ acceptance process simplified & survey parameters rationalized for expediting GIS mapping
 - Various studies have been undertaken – Impact Assessment, Segregation of losses, Best Practices



Impact Assessment carried out to assess benefits of IT implementation

- To assess measurable benefits realized by Consumers & Utilities
- **Sample study conducted in 76 towns across 14 States covering 10% of Go-live towns and 15% feeders in selected towns by ICRA, ERDA, NPC, Pranat Engineers**
- **Key Findings** - IT System has enabled -
 - Identification of AT&C Loss pockets where Discoms have started started taking corrective measures
 - ❖ AT&C Loss reduction reported in 85% of these towns
 - ❖ Benefits accrued due to reduction in AT&C losses corresponds to annual monetary benefit of Rs.185 cr (**extrapolated value for all 865 R-APDRP towns in these 14 states ~ Rs.5131 cr**)
 - Measurement of Reliability of Power viz. total hours of power supply
 - ❖ **>85% Reliability observed in 66 towns**
 - Establishment of Single Window Customer Care Center for all type of complaints
 - Web Self-service and multiple payment options



Study on Segregation of Commercial Loss from overall AT&C loss of 10 pilot towns – Feb 2016



- Study undertaken in towns of Vizag - AP, Bhatapara- CG, Panchkula- HR, Shimla- HP, Ahmedabad- Guj, Navi Mumbai - MH, Bhopal- MP, Hyderabad- Tel, Dehradun- UK, Kolkata - WB
- AT&C loss calculated through IT system
- Technical loss calculated using Network Analysis module developed under R-APDRP IT System
- Commercial Loss derived by **deducting Technical loss from AT&C loss**
- Observations based on Study –
 - Technical losses - 2.6% to 7.7%, Commercial losses derived - 1.4% to 36.9%
 - Commercial loss - major factor of high AT&C loss (66% to 92%)
 - Defective meters, Tampering, Theft & Pilferage, Poor metering / billing efficiency, Less/Non realization of dues against billed energy
 - Substantial reduction in AT&C losses can be achieved by reducing Commercial loss within short time with administrative interventions



Study of 10 DISCOMs where AT&C losses have reduced in last five years – June 2016



- Study undertaken in Discoms of **AP, Gujarat, Karnataka, Maharashtra, MP, Uttarakhand, West Bengal**
- Key findings of Study/initiatives taken by utilities in reduction of losses:

TECHNICAL

- ~100% Metering
- Segregation of agriculture load from existing rural feeders
- HVDS/AB cabling in theft prone areas
- Improvement in size of the conductor & HT/LT ratio to reduce losses
- Conversion of single phase -2 wire LT network into single phase-3 wire network
- Use of three/five star BEE rated Distribution Transformers and energy efficient pump-sets
- Regular load balancing/ load flow analysis of substations/feeders



Study of 10 DISCOMs where AT&C losses have reduced in last five years – June 2016



ADMINISTRATIVE

- Regularization of unauthorized/ghost consumers through special drive camps
- Feeder wise regular energy audit across Discom and take appropriate measures
- Implementation of feeder franchise model for improvement in billing and revenue collection as well as maintenance activities in rural areas
- Appropriate incentive mechanism for feeder managers for reduction of losses as well as incentive mechanism for informers of electricity theft

CONSUMER CENTRIC

- IT enablement of billing and collection throughout Discom
- Dedicated cell for high value consumers and monitoring
- Use of photo meter billing for minimizing billing complaints
- Online payment, Kiosk, ATP machines, mobile app etc. for ease of payment by consumers



Analysis^ of Quarterly AT&C loss report submitted by Discoms

S.No	State	Share in Overall Input Energy	Billing Efficiency _{BE}	Share in Overall Revenue Billed	Collection Efficiency _{CE}
1	Maharashtra	12.13%	86.6%	12.73%	92.1%
2	Tamil Nadu	11.23%	80.3%	11.96%	97.5%
3	Rajasthan	6.91%	78.0%	7.65%	94.1%
4	UP	9.30%	77.1%	7.52%	81.9%
5	MP	5.89%	75.8%	6.04%	93.9%
All India		100	82.0%	100	94.1%

- Maharashtra & Tamil Nadu account for 23% of Energy Sales, but **BE < 90%**
 - If BE increase to 90%, All India BE will increase by 1.5% i.e. over 10,000 MU
- Rajasthan, MP & UP account for 22% of Energy sales, but **BE < 80%**
 - If BE increase to 90%, All India BE would increase by 3% or over 20,000 MU

^upto Q3 FY17

BE in North East States is very low ~ 60%



Analysis^ of Quarterly AT & C loss report submitted by Discoms

S.No	Utility	Share in Overall Revenue Billed	Collection Efficiency CE
1	MSEDCL (Mah)	12.7%	92.1%
2	PVVNL (UP)	2.1%	86.8%
3	MPMKVVCL(MP)	1.8%	86.4%
4	DVVNL(UP)	1.7%	69.8%
5	PUVVNL(UP)	1.6%	73.0%
All India		100	94.1%

- Maharashtra is largest State in terms of revenue billed, **CE ~ 90%**
- If CE increases by 5%, All India CE will increase by 0.6% ~ Rs 1500 Cr/annum
- UP is also amongst largest State in terms of revenue billed, but **CE ~ 80%**
- If CE increases by 10%, All India CE will increase by 1% ~ Rs 2500 Cr/annum

^upto Q3 FY17

CE in North East States is very low ~ 40%-70%



Way forward for Discoms



Regular use of exceptions generated from IT system for review of its performance and take corrective measures to reduce AT&C losses

Analytical tools like GIS based Network planning & monitoring of feeder data can help Discoms in making better informed decisions

Separate fund for maintenance and upkeep of IT system - updated GIS and Meter Data Acquisition will ensure correct Energy accounting and audit

Dedicated IT team at Data Centre and in field shall ensure accountability and timely action towards fault restoration , **Regular Security Audit**

Appointment of feeder manager for each feeder, besides regular operation & maintenance for more accountability

Procurement of Quality equipments for Distribution system strengthening

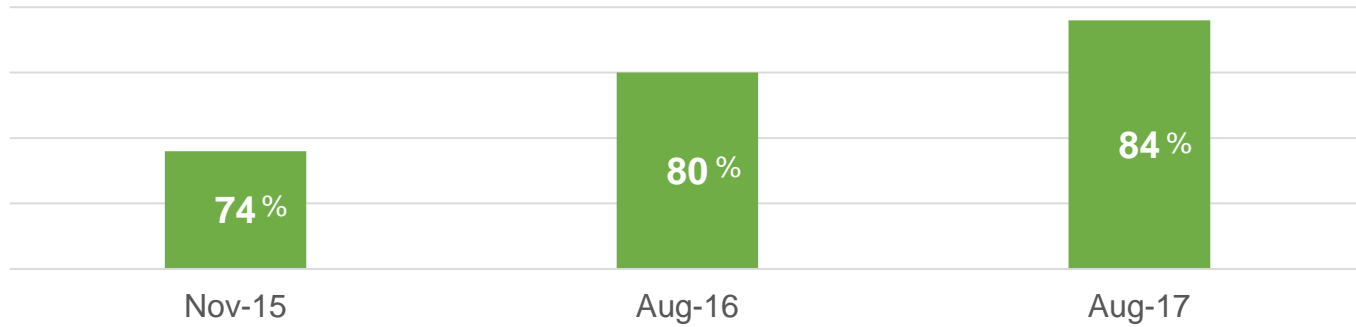
Training and Capacity Building of field staff will increase awareness and interest in system operation



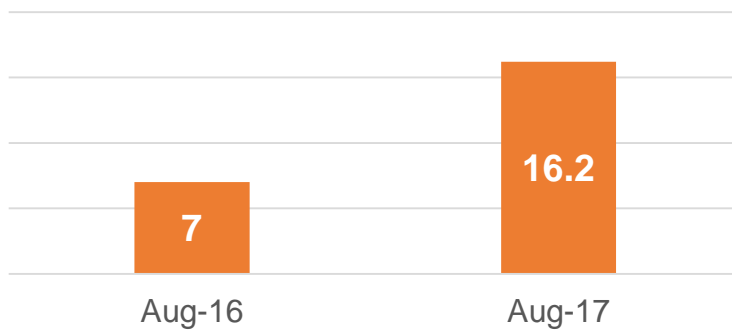
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Some outcomes of IT enablement

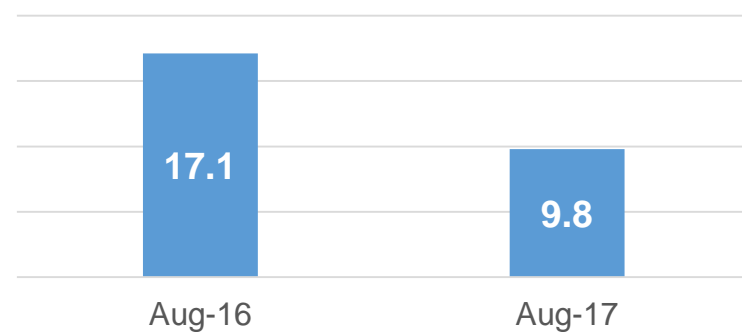
**% of Towns where AT & C has improved vis a vis
Baseline losses**



**% of Consumer making Digital
payments of Electricity Bills**



**% of Consumer complaints
pending**





Distribution Business Processes, IT Enabled



1. Metering
2. Billing
3. Collection
4. New Connection
5. Disconnection and Dismantling
6. GIS based Consumer Indexing, Asset mapping
7. GIS based Network Analysis
8. Customer Care Centre
9. Management Information System
10. Web Self Service
11. Meter Data Acquisition
12. Energy Audit
13. Commercial Database
14. Identity & Access Management
15. System Security Requirements
16. Maintenance management
17. Asset Management





Methodology for Technical loss computation



- Technical loss is computed using “GIS based Network Analysis” Module of IT system.
- All electrical assets starting from 11 KV breaker to consumer meter, covering all HT/LT conductors, DT, Service cables are mapped in hierarchical order on GIS platform along with their electrical parameters like:
 - Type, size, length of conductors and Service lines
 - Capacity of DT, its fixed & variable losses, etc.
- A default current is fed at 11 KV feeder in Network Analysis Module
- Based on above default current and sanctioned load of consumers linked to feeder, software module derives estimated current flow in each electrical asset/branch connected to the feeder. Estimated current flow in assets/branches are extrapolated on entire network on basis of actual feeder current
- Based on extrapolated currents, conductor size of each section of feeder and type of DTs used, system calculates technical loss of feeder.
- Methods to calculate technical loss:
 - Real Time Accumulation method - Technical loss of a feeder (including LT network up to end consumer) is calculated using average current of each 30 minute integration period
 - Peak Current method - In case of “Peak Current method” technical loss is calculated using peak current of feeder and multiply it with loss load factor (LLF) to get actual value



Town/Feeder/DT wise Energy Audit



- Energy Audit module collect data from MBC and MDAS module and use Consumer Indexing and Asset mapping database for deriving Energy consumption.
- Losses at various level can be monitored by Discoms for taking corrective actions as described below:
 - ❖ **Bus bar & transformation losses** (energy balance between HV and LV side of substation to calculate this loss.)
 - ❖ **HT losses** (energy balance of 11 KV feeder flow against consumption of HT consumers and connected DTs in feeder)
 - ❖ **DT wise Energy audit** (consumptions of all consumers on DT and compare with energy sent by DT meter on LT side)
 - ❖ **Segregation of Technical and Commercial losses**
- Discoms can take measures based on exception **reports generated through IT system**



Network planning tools to assist decision support system



- **Network Analysis Module enable Utilities** to perform actions for network optimization, loss reduction and network operation with improved efficiency and may include:
 - **Segregation of Commercial and Technical losses**
 - **Integration with New connection module** for checking the network capability, augmentation requirement on upstream side
 - **Load flow** and voltage drop analysis,
 - **Optimization studies** like capacitor placement, network reconfiguration, conductor up-gradation, express feeder, load balancing/ reallocation etc.
 - **Fault analysis** and protection coordination
 - Assessment of requirement of primary substations to meet load growth at min. cost.
 - Determine economic and break-even **loading limit of conductors/cables**.
 - Optimum DT (new or augmentation) over a selected regions or nodes.
 - Network design reports, cost estimates, financial analysis,
 - Creating extensive “what-if” studies etc.



Broad Objective and Scope under RAPDRP

• Objective:

- Reduce AT&C losses & improve Consumer services on sustainable basis though use of IT&C
 - Automated Energy Accg to identify key areas requiring adm./tech. measures
 - Enhance transparency in business operations and accountability
 - Objective evaluation of demonstrable performance of utilities due to implementation of RAPDRP
- Part-A (IT) scheme covers establishment of DC/DR, CCC and integrating utility offices with DC. All business applications hosted at DC accessed by town users through a secured and reliable connectivity (MPLS) and GPRS/CDMA connectivity at metering nodes for undertaking proper Energy Audit and ***taking corrective actions after Go live of Towns***
- Commercial business operations through IT system using Energy audit, MIS/exception reports.
 - Utilities to update & maintain system to derive benefits from R-APDRP.

Customer conveniences

• **Consumer Information Service-**

- ❖ A Centralized Single Window CCC linked with the automated business processes established in each utility. Consumer can call 1912
- ❖ CCC to automatically dial out/SMS to consumers to inform like power supply position, payment reminders, payment acknowl.
- ❖ Consumer friendly web portal -applicable policies of Utility, regulator.
- ❖ Information about power supply breakdown/schedule maintenance.

• **Delivery of e-Services –**

- ❖ Register on web portal, access account info, billing/ payment details, past consumption pattern, getting bill at registered email Id etc.
- ❖ Consumer can View and Pay bills online through multi payment channels (credit card, debit card, net banking, ECS, BHIM, UPI etc)
- ❖ Consumer can lodge request on web portal for services (New connection, load change, name change, category change, meter shifting etc.) and view status.

Customer conveniences

- **Complaints handling-**

- ❖ Consumer can lodge complaint thru CCC (No supply, metering, billing etc.)
- ❖ Can get status of complaint anytime on IVR system or through CCC
- ❖ complaint can be lodged on web or mobile and view the status.

- **e-Mobile services-** e-Mobile services can be launched for wider coverage among consumers.

- ❖ Consumer can register his Mobile number on Web portal or calling CCC for getting the e-services
- ❖ Can make payment of bill through mobile
- ❖ Can lodge complaint by sending SMS and get complaint status.
- ❖ CCC to sent group messages based on location to consumers' Mobile, such as power supply failure, load shedding/planned maintenance etc.