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Methods to Reduce Aggregate Technical and Commercial (At&C) Losses

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***Abstract*- In the Power Sector, Distribution system plays an vital role where, The gap between the average revenue Realization and the average cost of the supply has been constantly increasing since a decade. power is critical infrastructure for economic growth. However the financial growth of SEB's (State Electricity board)has become a matter of grave concern considering that their losses have reached a alarming level of 26,000crores which is equivalent to 1.5% of GDP in the year 2001 , All-India average AT&C losses(Aggregate Technical and Commercial) were pegged at 27.15% in 2009, in which southern region had an average of 19.49% and the north-eastern region 36.44%. Some states had loss levels as high as 70% and at the same time, some others had the loss average in single digit. So there is an emergency in reducing these AT&C losses by various preventive methods and reduction techniques so that we can utilize the power to various sectors i.e., we can reduce them to some extent but we cannot eliminate them completely we can reduce them to permissible Level of less than 15%.By using some best practiced methods such that we can eliminate the electricity crisis.**

***Keywords* – AT&C (Aggregate Technical and Commercial), Energy, Meters, Power**

I. INTRODUCTION

We have already seen that distribution system has more complexities compared to all the other sectors so it is necessary to discuss about power distribution sector complexities 1. Distribution Sector considered as the weakest link in the entire power sector 2.Involves dealing with retail consumers with varied expectation and at the same time different paying capacity 3.Involves Huge network and requires network management of vast area 4.Theft, pilferages, network losses are maximum in this segment 5.Distribution is often seen as a social obligation of Government toward 6.society rather than a commercial activity 7.Subsidized and often unmetered power adds to Distribution Utilities woes in terms of technical losses, billing, recovery and consumption habits 8.Since the metering, billing, and collection at many places involves human intervention most of the times human error, intentional or non intentional can occur 9. Lack of infrastructure in many developing countries for database management system and at the same time absence of any data mining system 10.Lack of employee ownership 11.Internal Resistance to change

Let us assume that if the total losses in power sector assumed to be 100% ,among these 50% of losses are mainly due to Distribution losses and 17% is due to Transmission losses. In olden days losses are termed as T&D(Transmission and Distribution) but now the distribution losses are increasing rapidly so we cannot treat them equally hence this is the key area to focus.

II. AT&C LOSSES

A. Definition: **"**AT&C Losses is nothing but the sum total of technical loss, commercial losses and shortage due to non realization of total billed amount**"**

B. Formula:
{(Total Energy Input LESS Energy Realized)/ Total Energy Input}*100
Where,
Energy realized =Sale of Energy * Collection Efficiency

We can define this in another way "The difference between energy supplied at the Input Points and Energy Billed to Consumer in percentage terms for a particular period"
(Energy Input less Energy Billed to Consumers in KWh/Energy Input in KWh)*10

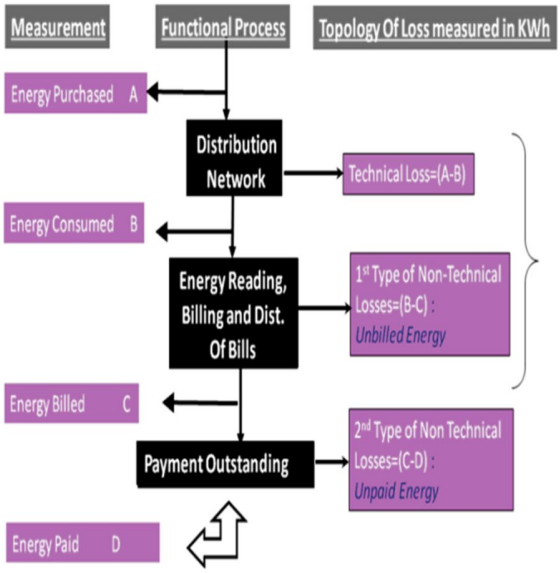

Fig I: Technical and Commercial losses

Losses occur due to 'Technical' and 'Commercial' losses Minimizing either Technical or Commercial Losses may not serve the purpose of any distribution utility and requires a simultaneous action.

II. CAUSES OF AT&C LOSSES

A. Technical losses:

1.Ill maintained equipment, substation and Ageing of transformers.2.Inadequate investment for infrastructure improvement.3.Overloading of system elements like transformers, feeders, conductors 4.In sufficient Reactive compensation e.g. non inclusion of appropriate capacitor banks at appropriate places 5.Non reconfiguration of feeder lines and distribution transformers so as to reduce the length of LT lines and 6.Non usage of smaller size energy efficient Distribution transformers

B. Commercial losses:

Theft and pilferage, Low metering efficiency, Non reading of meters, Faulty meter reading, Inefficient billing, Under billing, Faulty bill distribution, Software errors, Prolonged disputes, Inadequate revenue collection

III.TECHNICAL LOSS REDUCTION

A. Technical losses:

Technical loss of a network is a result of 1.Network Design. 2. Specifications of the equipments used in the network 3.Network operation parameters

The energy loss could be derived based on utilization pattern.

S.No.	System Component	Levels for Peak Power Losses	
		Target Level%	Maximum Tolerable %
1.	Step-up transformer and EHV transmission system	0.50	1.00
2.	Transformation to intermediate voltage level, transmission system and step-down to sub-transmission voltage level	1.50	3.00
3.	Sub-transmission system and step-down to distribution voltage level	2.25	4.50
4.	Distribution lines and service connections	4.00	7.00
	Total Power Losses	8.25	15.50

Fig II: System Components and their tolerable level

i.)Short term measures: 1. Network reconfiguration 2.Network reconductoring. 3. Preventing leakages at insulators. 4. Employing AVB (Automatic Voltage Booster)
5. Better management of Distribution transformers
6. Load balancing and load management 7.Capacitor Installation (Shunt or series) 8.Improving joints and connections 9.Laying Additional link lines 10.Increase in HT: LT Ratio
11. Adoption of high voltage distribution system (HVDS) 12.Regular maintenance of distribution network 13.Creation of Primary substation

ii.)Long Term Measures: 1. Data collection regarding existing loads, operating conditions, forecast of expected loads etc. from Grid substation up to consumer level.2.Mapping of existing system.3.Analysis of existing system (Voltage regulation T&D losses in existing system, Adequacy of backup system)4. Load recast.5.Plan for upgrading the network.6.Technology options including integration of features for modernization of system 7.Evaluation of various alternatives for least cost optimal solution. 8. Fuming up of scope of works. 9. Preparation of cost estimates.10.Phasing of works and their cost.11.Financial analysis.

IV. COMMERCIAL LOSS REDUCTION

A. Preventive Measures:

1.Defining installation procedures and ensuring that installation check points are tested/followed while installing meters.2.Use of electronic meters with tamper and load survey logging features for all categories of consumers.3.Use of optical port for taking the reading for all categories of consumers.4.Seating of meters with seals and having proper seal management system.5.Installation of CTs/Pts in sealed boxes

so that terminals are not exposed for tampering/bypassing.6.Testing of the metering system as a whole to ensure accuracy.7.Ensuring accuracy in meter reading and billing activities by generating exception lists and following up on exceptions.8.Carrying out regular energy audits covering the feeder DT and all end consumers to ensure that there is no revenue leakage beyond the permissible technical loss.

B. Planned Measures

1. Aerial Bunched Cables 2.HVDS or LT less system
3. Shifting of meters outside consumers premises.4.Spot Billing.5.Provision of additional counters, consumer collection centres6.Installation of electronic cash register.7.Drop box facilities8.Collection agencies9.E-bill payments 10.Online facilities
11. Development of MIS 12.Energy Accounting and Auditing13.User's Associations, panchayats and Franchisees in Billing &Collection

V. BEST PRACTICES FOR AT&C LOSSES REDUCTION

A. High Voltage Distribution System (HVDS)

HVDS envisages running 11 KV lines right up to a cluster 2 or 3 pump sets, employ small sized distribution transformers (15 KVA)and extend supply to these 2 or 3 pump sets with least (or almost nil) LT lines.

HVDS can be classified as:-

• Single Phase HVDS
• Three Phase HVDS

*i)Single Phase HVDS:*HVDS was first attempted as single phase system (i.e.) running one phase of 11 KV and one neutral wire from 33/11 KV SS, install small sized 5, 10 or 15 KVA single phase transformers 6350 / 230-0-230volts and changing all three phase pump sets to single phase pump sets.

ii) Three Phase HVDS: Existing LT lines are upgraded to 11 KV and small capacity 3-phase Distribution Transformers (15 KVA) are employed. The three phase load is feed by the three phase small capacity transformer. This results into improvements in tail-end voltage, reduction of losses.

*iii) Advantages of HVDS:*1. Customer has sense of ownership. 2. Prevention of unauthorized loads. 3. Minimal Failure because of on over loading and no meddling of LT lines.4. High quality of supply owing to practically no voltage drop.5.Less burnouts of motors because of good voltage and less fluctuations.6.Considerable reduction in line losses and consequent savings in power purchase cost 7. No additional generation capacity needed for giving new loads due to reduction in power drawls.
8. Accidents due to touching of snapped conductors reduce because the breaker trips at substation since the line is at 11KV Potential.

iv) Disadvantage: The system is not suitable to cater in certain areas like deserts, Forests because the load density in these areas is low and load development is also very slow

Fig III: single phase HVDS

B. Aerial Bunched Cables (ABC)

Where LT lines could not be totally avoided, ABC (Aerial Bunched Cables) with a bearer wire can be used.

The major advantages of ABC are elimination of faults on LT lines, improved reliability, Avoidance of Theft by direct tapping, Avoidance of Overloading of Distribution transformers

C. Metering

Static Energy Meters are utilized now-a-days at HT Services and LT High value Industrial services. The Static energy meters are microprocessors based. The programmability of microprocessor has become a useful tool to incorporate different features like Tamper data, Import-Export, Time-of day metering, load pattern analysis, Remote meter reading etc.

i) Tamper Data: The static meter can detect date pertaining to tamper such as

Missing potential: Gives the information regarding missing of supply to the potential coil and records the date and time of such occurrence.

ii) C.T. polarity reversal: The meter can also give information regarding availability of load current. The meter can also register the non-availability of load in a particular phase compared to the other phases.

iii) Phase Sequence Reversal: The meter can also recognize proper phase association.

ii) Time-of-day (TOD) Metering: The processor based electronic (static) meters have build-in Real-time clock, hence the time available in a day i.e., 24 hours is divided into different

time zones. The duration of each time zone is programmable and the user can define their time zones as per his requirements.

The meter records the energy consumed in different time zones in separate registers and exhibits accordingly

iii) Load Survey Data: The static meter has the provision to store the billing and tamper data for 35 days at the specified logging interval, say 15Mts/30 Mts. which is useful to draw the load curves of KWH & KVAH, KVA & KVAH. This is known as load survey data which gives complete picture of load pattern of that consumer. The interval by interval data from this function helps in several ways.

The energy supplied to the feeder(s) by the DT can be windowed (sliced)so that it aligns with the energy consumption from the route meter readers. This reduces the "time parallax" problem that plagues energy accounting at the feeder level. The magnitude of the peak load on the transformer can be measured.

The time of the peak load on the transformer can be measured

iv)Import/Export Metering: The static meter can measure the energy in both directions etc., the consumer acting as a load for some time and feeding into the grid for some other time.

v) Meter Reading Instruments: The meter reading instrument (MRI) is a simple hand held terminal used for data transfer from/to meter to/from the system-computer.MRI can be used for data transfer from HT tri vector meter for analysis of data& billing.

The MRI can be preloaded with meter numbers to be read and optionally the MRI can also have a bar code reader. The bar code reader will be useful to identify the serial number/identify of meter. In case of HT services with load survey data, MRI is very essential for transfer of data from meter to computer as the data collected is enormous and is not possible to read manually.

vi)Tele metering-Remote Metering: Transfer of metered data through a communication network is known as Tele metering. The meter is connected to say a telephone line at the consumer end via a Modem. At the system end also the computer is connected to the telephone via a modem.

Whenever data is to be accessed by the computer, the consumer telephone number host is dialed and the modem connected to the telephone connects to the meter. This type of metering system can be very useful in case of H.T. services as well as substation/services which require constant monitoring. The figure shown below represents the Tele metering which involves metering by using fixed network, drive by and also by using some communication network.

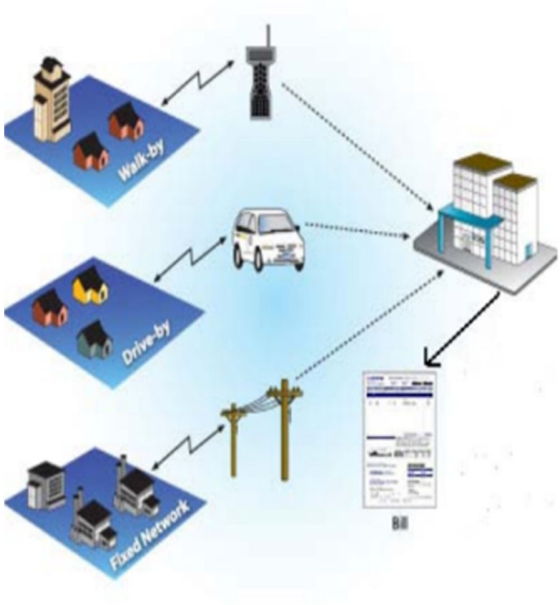

Fig IV: Tele metering

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D. Eliminating Defective metering, billing and collection functions:

These losses are not due to any deliberate actions of the customers. They are due to internal short comings and hence are that much easier to tackle. This has sustained over years because of absence of focus on commercial areas.

i)Metering: There are many unmetered services. A large scale drive is necessary to bring all unauthorized consumers on to the rolls. All the existing unmetered services shall be stopped to be so immediately. The utility should concentrate on purchasing of adequate quantity of meters both for fresh services and for replacement of the defective meters in the existing services. Purchasing of other materials shall be given low priority, if the financial position demands it.

ii) Billing: Correct billing and timely serving will go a long away in improving the collections. The normal complaints in the billing process are: non receipt/late receipt of bills, receiving of wrong bills, wrong reading/status, table readings and wrong calculations. All these can be avoided in a single go by going for computerized spot billing as is already done in some states. A thorough understanding by the readers on the various statuses of the meter is a sine qua non for the success of the system.

iii) Collection: Increased customer convenience shall be the guiding factor for smooth collections. Drop box facilities and bringing in more collection agencies will make the lengthy queues vanish E-Payment centers will give relief to the customer as around 25 types of bills can be accepted in a cool atmosphere at convenient hours. Online facilities like bill junction are extended. Special collection drives, coupled with intensive inspections, in the areas where the payment history was bad, should be adopted. Effective disconnection of defaulters should be a norm rather than a chance occurrence. CAT is to be applied and high areas services are to be targeted.

VI. AT&C LOSSES IN THE REAL SCENARIO

Gujrat	DGVCL	11	18.67	2009-10
Gujrat	PGVCL	36	36.16	2009-10
Gujrat	UGVCL	20	16.97	2009-10
Gujrat	MGVCL	17	13.08	2009-10
Haryana	DHBVNL	9	24.79	2011-12
Haryana	UHBVNL	16	24.90	2010-11
Himachal Pradesh	HPSEB	14	16.05	2010-11

Fig v: year wise AT&C losses for some states

In the figure we can observe the AT&C losses for some states in particular years similarly for every state there will be losses which can be reduced below 10% by necessary methods according to the recent survey in the year 2010 Karnataka state has highest percentage of losses of 41% .this means out of the total power generated 41% is going waste which meant a lot in terms of economy

VII. CONCLUSION

We can reduce the AT&C losses to some extent but We cannot eliminate them completely we can reduce them to below 10% so that the gap between the generation and utilization will be reduced hence government sector will be ahead in the competition with the private sectors which in turn helps to improve our Indian economy

VIII. LATEST IMPROVEMENTS

Recently government has taken a step for the reduction of losses in the distribution system by digitalizing and updating the Distribution system and also providing incentives to the substation engineers who has taken special interest in reducing AT&C losses

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