

Analysis of R-APDRP Implementation in Improving the Distribution Efficiency

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ABSTRACT

Power sector in India started from 1991. Where more attention is focused on generation site. Later on it comes into observation that power distribution is the weakest site in entire power sector therefore GOI conducted APDP in 2001-2002. But due to certain limitations APDP was modified as APDRP in 10th five year plan (2002-07) as central sector scheme. Whose main aim is to reduce AT&C losses to 15%. Due to some failure in APDRP it is renamed as R-APDRP in year 2008 for improvement. This paper gives the analysis of R-APDRP implementation in reducing the AT&C losses in Kamptee & katol city.

INTRODUCTION

Economic growth of the country greatly depends upon power sector [4] & power sector is one of the most important aspect in Indian economy, but it was facing some serious problems such as old warn out, poor distribution system, complicated tariff structure, huge transmission & distribution losses due to theft & unmetered supply, high LT/HT line ratio, overloaded DT/lines, Distribution set up of state electricity board etc. Hence financial condition of state electricity board has becomes matter of great concern where Aggregate losses of country had reached Rs.26000 Cr. during 2000-2001[4]. Hence government of India initiated power sector reform to improve the efficiency of power sector [9]. Government took various initiatives in this direction; one of these is the introduction

of APDP. APDP program was initiated in February, 2000[5].

Objectives of APDP are –

- i) Renovation and modernisation, Life extension, upgrading of old thermal & hydro plant
- ii) Up gradation and strengthening of sub-transmission and distribution network along with energy accounting & metering in distribution circle.

This program is continued for 2 years but it has several limitations. Therefore in 2002-2003 APDP was renamed as APDRP. It aims at strengthening and up gradation of the sub-transmission and distribution system in the country with following objectives.

- i) Reduce AT&C losses
- ii) Improving quality of supply of power.
- iii) Increasing revenue collection.
- iv) Improving consumer satisfaction [4, 5].

Reform is taken in the form of increased metering, conversion of unmetered connection to metered connection, addition of fresh connection, billing and commercial efficiency [4]. To perform reformation GOI provides fund in the form of grant & loan and after completion of reformation in given period of time loan is converted into grant. The funds under this programme are provided in two components:

- i) Investment component:
Fund= Grant+ Loan

ii) Incentive component:

Fund= Grant+ Loan i.e. 50% grant + 50% loan

Limitations of APDRP:

- i) Lack of experience of state electricity boards.
- ii) Delay in transfer of APDRP fund by state government to SEBs/ utilities
- iii) Delay in processing of tendering, evaluation and award of contracts.
- iv) Non availability of equipments / contractors to execute the work [1].

Hence it is observed that there is poor response from contractors or suppliers and there was less utilization of fund. Therefore APDRP could not achieve its goal in desired time so GOI come with another project, during XIth five year Plan it is restructured as R-APDRP whose aim is to reduce AT&C losses to 15% in urban areas. Project under the R-APDRP program shall be taken up in 2 parts, i.e. Part A & part B. Under the part-A IT application is used and under the Part- B regular distribution strengthening projects are included. R-APDRP covers urban areas & towns with population more than 30,000 (10,000 in case of special category states) [4].

This paper gives detailed information about AT&C losses in Umred city before implementation and after implementation of R-APDRP. From which it is observed that before implementation losses are near about 30% .Therefore GOI decided to reduce this losses to 15% by implementing R-APDRP. The main objective of this paper is to study the AT&C losses before & after the implementation of R-APDRP. This paper discusses information about R-APDRP in section II, research objectives in section III, project work in section IV & conclusion in section V.

R-APDRP:

R-APDRP is considered as central sector scheme during XIth Five year plan with the following revised terms and condition:

- i) The focus of the program shall be on actual, demonstrable performance in terms of sustained loss reduction.
- ii) It is proposed to cover urban areas, towns & cities with population more than 30,000 (10,000 in case of special category states).
- iii) The area which is covered in Xth plan should be considered for XIth plan only after either completion or short closure of earlier sanction projects.
- iv) Project under the scheme shall be taken up in two major & one minor component as Part- A, Part- B & Part –c respectively [7].

Part-A: Part A of the scheme covers application of IT in distribution side. The scheme shall involve implementation of IT technology for data acquisition, new connections/ disconnections, energy accounting & audit, network analysis. This is aimed to establish Base line Data collection system for the distribution utilities through which they are able to minimize AT&C losses without manual intervention and also to plan & implement corrective measures in Part B.

Part-B: Scheme covers system strengthening, improvement and augmentation of distribution system. This shall involve:-Identification of high loss areas

- Preparation of investment plans for identified areas
- Implementation of plan
- Monitoring of Losses

Part-C: conducts workshop, conferences etc.

To perform activities under different components GOI provides fund in the form of grant & loan. Therefore funding Mechanism under R-APDRP is given below for Part-A, Part-B & Part-C.

Part A: Initially 100% funds for the approved projects shall be provided through loan from government of India on the terms decided by the ministry of finance. The loan will be converted to grant once the required system is achieved and verified by independent agency. No conversion to grant will be made in case part A is not completed within 3years from date of sanction of the project.

Part B: Initially up to 25% funds for the project shall be provided through loan from GOI on terms decided by ministry of finance. For special category states, loan from GOI would be 90%. Every state is not eligible for availing APDRP fund. Hence there are some criteria to decide availing fund.

Eligibility criteria for R-APDRP [7]:

- i) Constitute the state electricity regulatory commission
- ii) Achieve the following target of AT&C loss reduction at utility level:
 - Utility having AT&C loss above 30%:
Reduction by 3% per annum
 - Utility having AT&C loss below 30%:
Reduction by 1.5% per annum
- iii) Submit previous years AT&C loss figure of project area as verified by independent agency appointed by Ministry of power.

Guidelines for Part-B:

1. Part B of the R-APDRP covers system improvement
2. The Part-B project should be complete within three years from the its date of sanction. Fund released to the Part-B project should be limited to first three years, from its date of sanction.
3. The Utility will have to certify and sign the DPRs.
4. Utility should prepare a plan for R-APDRP implementation [3].
5. Works which is in progress should not be included in the new schemes under R-APDRP.

6. Utility shall submit DPRs of all Project Areas (Towns) to nodal agency (PFC) for approval of Steering Committee.

7. The Utility shall work out the AT&C loss of the project / town and facilitate with independent agency.

8. The AT&C loss of the project area should be certified by TPIEA before start of Part-B works, which should be treated as Base Line AT&C loss of the project area for all purposes.

9. In the Project area SCADA system should be implemented.

The main aim of R-APDRP is to reduce AT&C losses below 15% especially in urban area.

Concept of AT & C Losses:

The AT&C Losses comprise of two elements:-

1. Technical Losses:

The technical losses primarily take place due to the following factors:-

- a) Transformation Losses
- b) High Copper losses on distribution lines: It is due to the inherent resistance & poor power factor in the electrical network.

Technical losses vary with type of conductors used, transformation capacity of transformer & reactive load among other factors.

2. Commercial Losses:

The commercial losses are primarily due to illegal consumption of electrical energy. The factor which are responsible for commercial losses are:

- a) Meter Reading: Due to zero consumption of electricity because of locked premises, defective meters, temporarily disconnected consumer.
- b) Metering: Commercial losses through metering can be in the form of meter tampering in various forms, bypassing of meters, use of magnet to slow down the meter etc.

- c) Theft by direct: This is most common & visible form of commercial losses where people tap L.T. lines through direct hooking.
- d) Collection efficiency: When utility is not able to collect complete amount billed by it then there will be low collection efficiency which gives higher commercial losses [6].

RESEARCH OBJECTIVES:

- The objectives of this project are as follows:
1. Improving financial viability of State Power Utilities
 2. Reduction of AT & C losses to around 15%
 3. Improving customer satisfaction
 4. Increasing reliability & quality of power [4].

Methodology:

Following steps are used to calculate AT & C losses

1. Computation of input energy: Install meters at input points of each of feeders & read them at predefined interval

Input energy= Input energy meter- Export energy

2. Computation of sales: across the states there exists metered & unmetered consumer. For metered consumers billing is done according to the energy recorded by meter & for unmetered consumer billing is done according to norms defined by respective state regulatory commission.

3. Computation of Billing Efficiency: Billing efficiency indicates billed for energy supplied to consumer

Billing Efficiency = Total Units Sold (kWh)/Total Input (kWh)

4. Computation of Collection Efficiency:

Collection Efficiency = Revenue Collected (in Rupees)/Billed Amount (in Rupees)

5. Computation of AT&C Losses:

AT&C Losses = {1- (Billing Efficiency x Collection Efficiency)} *100 [1, 6].

CASE STUDY:

1. Collection of data
2. Case study of data
3. Comparative analysis

Particulars		Commercial information		
		Previous FY-1(08-09)	Previous FY-2(07-08)	Previous FY-3(06-07)
Peak Demand (Met)	MW	7.6	7.4	7.1
Peak demand (unrestricted)	MW	8.5	7.9	7.5
Energy input	MU	23.2	20.1	20.1
Metered energy sales	MU	14.32	12.6	12.4
Assessed energy	MU	0	0	0
Total energy billed	MU	14.32	12.5	12.4
Revenue billed	Rs.lac	550	490	478
Revenue collected	Rs.lac	518.6	418	398
Billing efficiency	%	61.72%	62.19%	61.69%
Collection efficiency	%	94.29%	85.31%	83.26%
AT&C losses	%	41.80%	46.95%	48.63%

4. Result and conclusion

1. Collection of Data:

Data regarding R-APDRP of Kamptee & Katol city which is given below in tabular form:

- i) Before R-APDRP implementation (Kamptee):

Before the implementation of R-APDRP in kamptee city it is observed that AT&C losses are near about 50%. Which shows that there is large technical & commercial losses are there in this city? Billing efficiency is continuously

decreasing in each year and it is near about 60%. Which shows that there are large losses are occurring in this city. Hence GOI decided to implement R-APDRP project in distribution site to reduce AT&C losses below 15 %. This program is started in 2009 and its scheduled date of completion is 2014 which is five year period.

ii) Before R-APDRP implementation (katol):

Particulars	Commercial information			
		Previous FY-1(08-09)	Previous FY-2(07-08)	Previous FY-3(06-07)
Peak Demand (Met)	MW	6.5	5.85	5.52
Peak demand (unrestricted)	MW	0	0	0
Energy input	MU	10.86	9.77	9.23
Metered energy sales	MU	7.97433	7.17689	6.77818
Assessed energy	MU	0	0	0
Total energy billed	MU	7.97433	7.17689	6.77818
Revenue billed	Rs.lac	39.87215	35.88493	33.89132
Revenue collected	Rs.lac	38.32042	34.48837	32.57235
Billing efficiency	%	73.43%	73.46%	73.44%
Collection efficiency	%	96.11%	96.11%	96.11%
AT&C losses	%	29.43%	29.40%	29.42%

Before the implementation of R-APDRP in katol city it is observed that AT&C losses are near about 30%. From table it is observed that collection efficiency & billing efficiency is near about same. There is not improvement in collection & billing of amount. Which shows that there are large losses are occurring in this city. Hence GOI decided to implement R-APDRP project in distribution site to reduce AT&C losses below 15 %. This program is started in 2009 and its scheduled date of completion is 2014 which is five year period.

2. Detailed Study of Data:

a) Kamptee:

The project covers an area of 15 Sq.Km of Kamptee town under the Nagpur DN I Division. The input Energy to the project area is 24.60 MU and the Energy sale is 15.32 MU. The improvements are proposed for reducing the Technical loss due to overloading of feeders and transformers, aging of conductors, low HT/LT ratio, poor voltage regulation, low power factor etc. The project will reduce the overloading of feeders and transformers and improve efficiency in distribution of power for satisfaction of the consumers due to which it improve the system reliability, reduce interruption and reduces the AT&C loss from the current value of 28.09% to 15%. Before the start of this project in Kamptee city major portion of distribution set up was layed before 40 years ago. Hence it consist of loaded feeders and DTC's, inadequate conductor size which results into technical losses. Total project cost is Rs.9.03 cr. Hence R-APDRP is proposed to reduce AT&C losses by improving existing system.

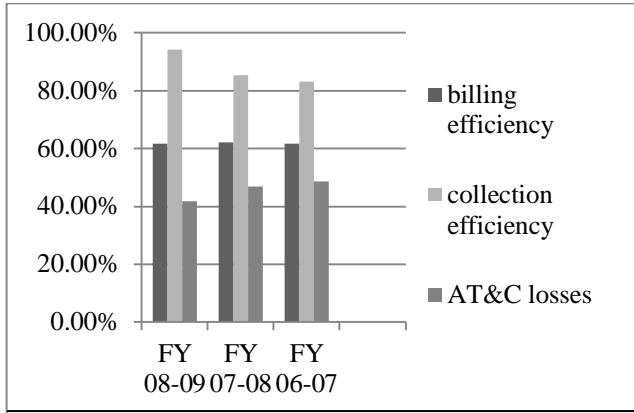
b) Katol:

The project covers an area of 28Sq.Km under the jurisdiction of Katol Division. The area comes under the jurisdiction of six sections namely Katol U-I and Katol U-II Electrical Operation sections. The input Energy to the project area is 10.86 MUs and the Energy sale is 7.97 MUs. Base AT &C loss is 37.00%. It will improve the system reliability; reduce interruption and bring down the AT&C loss from the current value of 37.00% to 15%. Total project cost is Rs. 4.13 Cr.

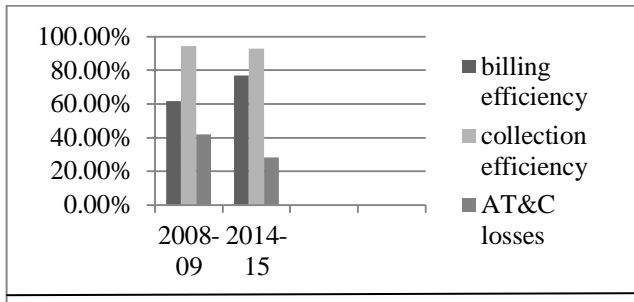
3. Analysis of Data:

a) Kamptee :

i) Before R-APDRP implementation:

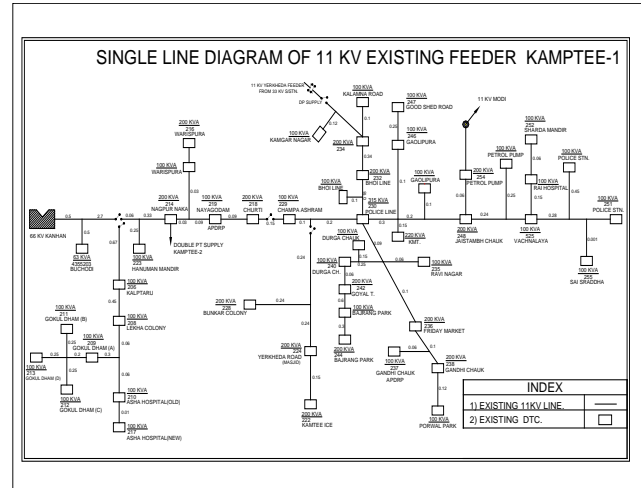


ii) After R-APDRP implementation:



Work covered under this project:

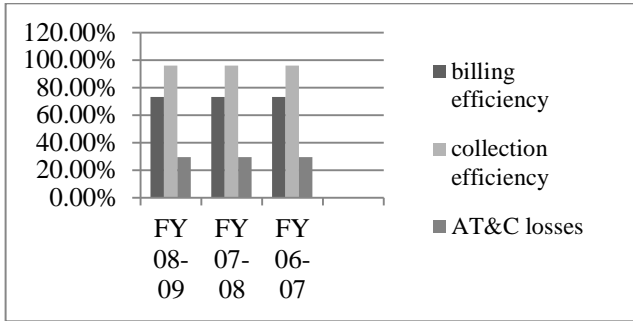
Renovation of dragon palace sub-station is taken which is 30 year old where Electrical equipment like breakers are old & no. of accidents have been increased, hence renovation & modernization of this sub- station is proposed by replacement of 33kv indoor OCB (oil circuit breaker) by outdoor VCB (vacuum circuit breaker). 1*5 MVA transformers are replaced by 1*10 MVA transformers. New L.T. lines of 6.12 kms is proposed with aerial bunched cable to protect it from direct hooking. To reduce the commercial losses tamper proof meter boxes with meters for 1500 consumers are proposed. Three Phase meters are 500 and Single phase meters are 1000. This work covered is shown in figure which is given below.



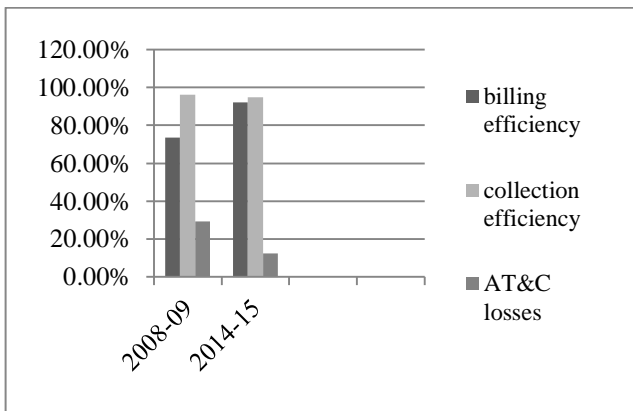
The transformer which is used in sub-station whose specifications are given below in tabular form:

Transformer specifications	
Transformer specification Ref I.S	2026
Guaranteed max. temp rise in oil	45° c
Type of cooling (oil)	On
K VA rating	400
Volt at no load	HV- 11kv LV-433v
Line ampere	HV- 21 LV-533.3
Phases	HV-3 LV-3
Frequency(C/S)	50Hz
Impedence %	4.9097
Vector Diagram	DY11
Maker's serial no.	ME/0607/236
Year of manufacture	2006
Core & winding K.G.	815
Weight of oil K.G.	453
Total Weight K.G.	1620
Oil quantity liter	540

b) katol:
 i) Before R-APDRP implementation



ii) After R-APDRP implementation



The present Distribution system in Katol town is having major part layed 40 years ago by the Licensee. Hence consists of loaded feeders and DTC's, inadequate conductor sizes resulting in technical losses. These are proposed to be reduced by 2 to 3 % by implementation of this scheme. At present Katol urban area is being fed at 11kV level from existing 132 KV Katol S/S. There are two feeders namely Katol U-I & Katol U-II. These two feeders are having lengths of 17.5 and 12.67 Km respectively. The technical losses are very high. Hence new 33kV feeder 2 Km in length is proposed from existing 132kV Katol Sub-station.

The existing Katol U-I feeder is 17.5 Km long. Similarly the 11KV Katol U-II feeder is 12.67Km is long so reducing the length of feeders we intend to minimize the conductor losses. This will also help to improve performance indices. Installation of New Transformers is necessary as most of the existing DTC's are loaded more than 80 %. New

additional DTC's are proposed to bifurcate the load of existing DTC's. Total no. of New Transformers is 20 No. As most of the load is residential and commercial the power factor is mostly lagging 0.8. To improve the same, it is proposed to establish pole mounted capacitors bank (4x0.66 MVAR) at new 33/11KV Katol substation.

This will improve system power factor reducing the losses thereby. In Katol town the residents in the area put hooks on L.T. line. Due to there is high loss of energy. To arrest these activities proposed 3 KM of A.B cable .To reduce the commercial losses tamper proof meter boxes with Single Phase meters for 2000 consumers are proposed. Transformer specifications used in the sub-station is given below in tabular form.

Transformer specifications	
Transformer specification Ref I.S	2026
Guaranteed max. temp rise in oil	45° c
Type of cooling (oil)	On
KVA rating	400
Volt at no load	HV- 11kv LV-433v
Line ampere	HV- 21 LV-533.3
Phases	HV-3 LV-3
Frequency(C/S)	50Hz
Impedence %	4.9097
Vector Diagram	DY11
Maker's serial no.	ME/0607/236
Year of manufacture	2006
Core & winding K.G.	815
Weight of oil K.G.	453
Total Weight K.G.	1620
Oil quantity liter	540

4. Result:

After the implementation of R-APDRP in Kamptee & katol city what is the effect on AT&C losses is shown in tabular form which is given below:

In Kamptee city before the implementation of this project base line AT&C losses were 47.47% which is very high & after the implementation it is reduces to 28.39%. Losses were not reduced below the 15% but it is observed that before the implementation losses were very high & after the implementation losses were reduced by near about 20%. This project will be continuing in this city to achieve its goal. In Katol city base line AT&C losses were 21.8% & after the implementation it is reduces to 12.6%. Hence this project is successful in this city.

CONCLUSION

this paper it is concluded that in Kamptee city AT&C losses are near about 50% which is very high & in Katol city AT&C losses were near about 25%.

In 2009 GOI restructured electricity board and implemented R-APDRP in India due to which they are able to minimize AT&C losses below 15% as decided by the government of India. So this project is also started in Kamptee & Katol city in year 2009 & its sanctioned date of completion is year 2014. From above case study it is observed that AT&C losses are reduced to 28.39% in Kamptee & 12.6% in Katol city. Hence we can conclude that AT&C losses can be reduced by implementing R-APDRP. With the reduction of AT&C losses below 15% we can say that there is large savings of natural resources which is depleting day by day due to which there is saving in electricity at each stage i.e. generation , transmission & distribution. Hence, this project should be implement at each city where population is above 30,000 (10,000 in special category states) and obtain renovation by reducing the losses. Hence this project is

Sr .n o.	Town	Base line % AT&C losses	Date of go live	% collection efficiency	% billing efficiency	% AT&C loss
1.	Kamp tee	47.47	26/4/13	93	77	28.39 %
2.	Katol	21.8	22/1/13	95%	92%	12.6 %

successful in these cities and also in various parts of this country.

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