



Title of the study

Installation of Auto Reclosures to 11 KV feeders of Doddaballapur sub division.

Site address

Doddaballapur sub-division, Bangalore Electricity supply company limited

**Period of study
Rating**

**October 08 to March 09
* * * ***

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1. Introduction

Network management particularly the operation of 11KV distribution network is very important for providing reliable and quality power supply to the rural areas. The rural distribution network is all overhead system. The area covered by the rural feeders is very large and the lengths of the feeders are also high. Added to this the length of branch lines feeding to isolated loads make the system operation more complicated.

In the present system the GOS are used for dividing the feeder in to various sections which are utilized for isolating a part of the line. In case of feeder fault conditions, isolation of faulty section and restoring power supply to healthy section has to be done quickly. The isolation of faulty bit takes a long time as each GOS has to be tried on trial and error basis and these isolation points are spread over a large area. Even temporary faults like bird fault or falling of a small tree branch etc, occurring in an isolated area also results in interruption to the whole area due to tripping of the feeder at the Sub Station. Even for isolation of any small section of the line the entire feeder has to be switched off at the Sub station end as all the isolators existing in the field are off load operating type hence carrying out regular maintenance works and new extension works also contribute to interruptions. This type of frequent line breaks results in poor customer service and consumers are not at all satisfied.

Faults on overhead lines can be classified into three categories (a) transient (b) semi-permanent and (c) permanent. 80-90% of faults on any overhead line network are transient in nature. The remaining 10%-20% of faults are either semi-permanent or permanent. Transient faults are commonly caused by lightning and temporary contact with foreign objects. The immediate tripping of one or more circuit breakers clears the fault. Subsequent re-energisation of the line is usually successful. A small tree branch falling on the line could cause a semi-permanent fault. The cause of the fault would not be removed by the immediate tripping of the circuit, but could be burnt away during a time-delayed trip. Permanent faults, such as broken conductors, must be located and repaired before the supply can be restored.

All this type of negative consequences can be over come by providing a few on line switching devices capable of operating in ON LOAD conditions with protection arrangement, similar to a circuit breaker in the middle of the 11 KV network and for long branch lines. Auto Reclosures serves this purpose very well as it can perform the following:

- a) ON LINE Switching operations
- b) Automatic tripping on fault
- c) Can perform Automatic closing operations with time lag which restores power supply quickly in case of temporary faults.
- d) Suitable for out door use.

Use of Auto Reclosures benefits the system as follows

- Improved reliability of supply
- Better customer service
- Improved customer satisfaction
- Reduction in duration of break down time.
- Better quality of supply.
- Quick restoration of power supply in case of temporary faults
- Easy identification of faulty section.
- Taking LC (Line clearance) is easier due to Online switching operations
- Improvement in performance of various reliability indices

2. Scheme Profile

Doddaballapura sub division of BESCO, the pilot site selected for implementation of DRUM initiative receives its power requirement from 55 numbers 11KV feeders emanating from five 66/11KV sub stations situated in Doddaballapura Taluk. There are 48 numbers of rural feeders out of total 55 feeders. The length of each of the rural feeder is of the order of 25 to 40 kms approximately. As part of the DRUM initiative, BESCO decided to install 15 numbers of Auto Reclosures on 15 identified feeders of which 2 are urban feeders and 13 are rural feeders. These feeders were selected on the basis of the number of interruptions and the total length of the line and also keeping in view that at least one feeder in each of the sub-stations in Doddaballapur sub-division is covered in the scheme as could be seen from the table shown below: -

Details of interruptions prior to commencement of work							
Sl.No.	11KV Feeder No	Sub station	Length of the feeder	Total			
				Interruptions from Feb. 07 to Jan.08			
				Unforeseen		Planned	
				Nos	Duration Hours	Nos	Duration Hours
1	DF-2	D Cross	31.7	163	80	50	27
2	DF-4		47.8	284	248	226	187
3	DF-5		50.6	280	189	96	48
4	DF-6		18.68	159	70	223	172
5	DF-7		10.3	95	59	191	155
6	DF-9		42.1	187	118	62	28
7	DF-10		32.7	225	70	160	111
8	DF-12/TF-6		46.05	254	156	117	63
9	KF12	KIADB	23.7	393	142	113	100
10	DBF-2	Doddabelavangala	32.8	121	139	149	271
11	DBF-4		67.4	190	356	101	262
12	DBF-5		35.3	115	109	121	2269
13	DBF-6		46.4	159	272	99	254
14	TF-3	Tubugere	8.5	7	7	53	53
15	KSF-3	Kanasawadi	15.0	122	100	91	73

The Auto Reclosures installed are pole mounted type. It consists of main cabinet (tank) which houses the vacuum interrupters and operating mechanism and a control box consisting of electronic components for closing and opening operations of the Auto Reclosure. It has 100 numbers event memory, events such as, circuit breakers close, trip, relay pickup etc., are available with date and time of occurrence. The Auto Reclosures also have provision for manual switching operators. The auxiliary power supply for electronic circuits and the operating mechanisms which are responsible for automatic operations of various functions of the equipment is supplied by an inbuilt power pack. In case of tripping of the Auto Reclosures on faulty conditions 4 numbers closing operation are performed before locking out. This has a four shot auto reclose with adjustable dead time for each shot. The switching operations of the Auto Reclosures can be carried out from the control box mounted on the pole at a convenient height. The local - remote control switch enables the operation of the Auto Reclosures locally also.

3. Implementation

Out of the existing 55 feeders 15 feeders were selected and one Auto Reclosures has been provided for each feeder at the distance wise mid point of the line.

The feeders are so selected that the feeders from all the 5 Sub stations are covered. The work of providing the auto reclosures to all 15 feeders was completed during December 08.



Photographs showing the Mounting details of Auto reclosures on single pole (RCC square type) for 11 KV feeders at project site

Details of the 11KV feeders to which Auto Reclosures are provided:

Sl No	Feeders No/Name of the Sub Station	Feeders Name	Location of Auto reclosure	O & M Section
1	DF 6/ D- Cross,D.B.Pura	Telephone Exchange	Islampura	O&M 1 D.B.Pura
2	DF 7 D- Cross,D.B.Pura	DB Pura Town	Mangala School	O&M 1 D.B.Pura
3	KF 12/Industrial Area D.B.Pura	Aralu Mallige	Aralu Mallige Village	O&M 1 D.B.Pura
4	DF 2 D- Cross,D.B.Pura	Ragunathpura	Ragunathpura Village	O&M II D.B.Pura
5	DF 10 D- Cross,D.B.Pura	Vasavi Feeder	Madagondalli road (opposite to Jr college)	O&M II D.B.Pura
6	KSF 3/Kanasawardi	Industrial Feeder	Kanasavadi	O&M Kanasawardi
7	DBF 2/ Doddabelavangala	Doddabelavangala Feeder	Puttena Agrahara	Doddabellaveangala O&M
8	DBF 4/ Doddabelavangala	Saslu Feeders	Saslu Village	Doddabellaveangala O&M
9	DBF 5/ Doddabelavangala	Hulikunte Feeders	Hulikunte village	Doddabellaveangala O&M
10	DBF 6/ Doddabelavangala	Sakkare gollahalli Feeder	Sakkare gollahalli Village	Doddabellaveangala O&M
11	DF 4 D- Cross,D.B.Pura	Hanabe Feeder	Hanabe Village	Doddabellaveangala O&M
12	TF 3/ Tubgere	S S Ghali Feeder	S S Ghali Village	Tubgere O&M
13	DF 5/ D Cross	Antarahalli Feeder	Gollalli Village	O&M II D.B.Pura
14	D12 &TF 6/ Tubgere	Gantigana halli Feeder	Gulya Village	Tubgere O&M
15	DF 9/D- Cross,D.B.Pura	Rajagatta Feeders	Konaghatta Village	Tubgere O&M

4. Results

As per the prevailing practice, the rural operation & maintenance section gets the complaints attended through the camp lineman. These linemen are based in various villages and are responsible for attending to complaints of 6 to 8 surrounding villages. Inception of Auto Reclosure has made their work easier as they could carry out the assigned maintenance works and rectification works easily as an on line operating sectionalizers is available for them to switch of the lines. The dual benefits are visible now (a) interruption from the substation end has considerably come down and (b) The feeder outage time in breakdown conditions has reduced many folds.

The duration of unforeseen as well planned interruptions have come down by 47% and 55% respectively after installation of auto reclosures. Details of number of interruptions both **unforeseen and planned** on each of these 15 feeders three months prior and after installation of auto reclosures is furnished below: -

Unforeseen interruptions feederwise pre and post implementation of auto reclosure scheme																		
Sl. No.	11KV Feeder No	Name of the feeder	Oct-08		Nov.08		Dec.08		Average for 3 months		Jan-09		Fe. 09		Mar-09		Average for 3 months	
			Unforeseen		Unforeseen		Unforeseen		Unforeseen		Unforeseen		Unforeseen		Unforeseen		Unforeseen	
			Nos	Duration Hours	Nos	Duration Hours	Nos	Duration Hours	Nos	Duration Hours	Nos	Duration Hours	Nos	Duration Hours	Nos	Duration Hours	Nos	Duration Hours
1	DF-2	Raghunathapura	2	2-24	2	1-12	1	0-10	2	1-19	1	0-10	8	0-36	18	7-20	9	2-42
2	DF-4	Hanabe	20	58-30	10	12-00	18	9-15	16	26-35	9	5-40	15	7-00	26	29-35	17	10-48
3	DF-5	Antarahalli	17	13-20	1	2-00	10	4-50	9	6-43	4	4-00	4	0-25	26	8-35	11	4-20
4	DF-6	Telephone Exchange	8	10-20	2	0-40	6	3-25	5	4-48	4	0-30	4	1-20	7	1-00	5	0-57
5	DF-7	Town	5	3-00	4	0-20	4	1-00	4	1-27	1	0-05	3	0-25	7	1-55	4	0-48
6	DF-9	Rajaghatta	8	5-15	9	3-05	7	8-30	8	5-36	3	1-30	11	12-00	18	4-20	11	5-57
7	DF-10	Vasavi	9	3-05	2	0-55	6	2-00	6	2-00	0	0	1	0-05	5	0-50	2	0-18
8	KF-12	Aralumallige	16	2-47	24	12-20	3	0-15	14	5-07	18	5-29	8	0-55	15	2-15	14	2-50
9	DBF-2	Doddabelavangala	18	15-30	18	12-00	6	2-10	14	9-53	0	0	6	5-00	18	5-10	8	3-23
10	DBF-4	Sasalu	32	28-00	44	50-00	14	21-30	30	33-10	15	14-10	15	6-00	21	13-20	17	11-10
11	DBF-5	Hulikunte	6	7-00	14	8-00	10	11-25	10	8-48	11	8-00	11	10-00	19	15-00	14	11-00
12	DBF-6	Sakkaregollahalli	12	19-00	16	10-00	6	2-10	11	10-23	8	10-00	18	6-00	17	09-50	14	8-36
13	KSF-3	Industrial	21	20-25	0	0	0	0	7	6-48	9	7-40	1	0-15	11	11-25	7	6-27
14	TF-3	SS Ghati	1	4-00	1	0-15	2	0-20	1	1-32	0	0	1	0-45	1	0-05	1	0-17
15	TF-6	Gantiganahalli	6	23-00	0	0	0	0	2	2-40	3	3-35	1	0-20	3	9-00	2	4-18

Percentage reduction in duration of unforeseen interruptions 47%

Planned interruptions feederwise pre and post implementation of auto reclosure scheme																		
Sl. No.	11KV Feeder No	Name of the feeder	Oct-08		Nov.08		Dec.08		Average for 3 months		Jan-09		Feb. 09		Mar-09		Average for 3 months	
			Planned		Planned		Planned		Planned		Planned		Planned		Planned			
			Nos	Duration Hours	Nos	Duration Hours	Nos	Duration Hours	Nos	Duration Hours	Nos	Duration Hours	Nos	Duration Hours	Nos	Duration Hours	Nos	Duration Hours
1	DF-2	Raghunathapura	3	4-56	1	0-15	1	0-15	2	1-49	2	1-15	1	0-15	2	1-00	2	0-57
2	DF-4	Hanabe	10	16-00	3	2-40	9	4-35	7	7-45	1	1-30	4	3-30	6	4-25	4	03-08
3	DF-5	Antarahalli	13	17-00	1	0-25	3	1-40	6	6-22	3	2-10	4	1-40	6	2-15	4	2-02
4	DF-6	Telephone Exchange	19	16-15	17	11-15	17	12-40	18	10-03	7	7-50	13	13-25	15	17-30	12	12-55
5	DF-7	Town	23	23-50	1	0-40	11	7-15	12	10-25	12	8-50	6	4-20	12	17-15	10	10-08
6	DF-9	Rajaghatta	7	3-50	2	0-20	4	4-55	4	3-02	2	1-10	1	0-10	9	3-30	4	1-37
7	DF-10	Vasavi	11	13-30	5	3-25	6	3-10	7	6-42	8	7-00	4	2-05	7	3-05	6	4-03
8	KF-12	Aralumallige	7	10-13	6	11-55	3	1-45	5	7-58	4	2-40	5	4-55	0	0	3	2-32
9	DBF-2	Doddabelavangala	11	16-30	16	12-00	12	14-00	13	14-00	2	4-00	4	5-00	14	11-00	7	6-40
10	DBF-4	Sasalu	18	58-30	20	26-00	21	54-00	20	46-17	6	9-00	17	8-00	14	12-30	12	9-50
11	DBF-5	Hulikunte	4	6-00	10	14-00	20	30-15	11	16-46	10	19-00	12	9-00	14	12-30	12	13-37
12	DBF-6	Sakkaregollahalli	16	44-30	28	34-00	18	50-00	21	42-50	7	9-10	10	3-20	13	10-00	10	7-37
13	KSF-3	Industrial	5	6-05	0	0	0	-	2	2-02	63	5-19	63	5-02	71	3-42	66	4-41
14	TF-3	SS Ghati	9	4-35	6	6-40	4	8-55	6	6-43	1	1-35	1	0-50	0	0	1	0-48
15	TF-6	Gantiganahalli	1	1-00	0	0	0	2-40	0	1-13	1	1-00	4	2-40	8	4-00	4	2-33

Percentage reduction in duration of planned interruptions 55%

Number of operations of the auto reclosures was also checked from the counter provided in the control to verify the accuracy. As observed, the number of interruptions would have been 20 to 30% more but for the installation of auto reclosures. The consumers have also expressed their satisfaction on the improvement in reliability of supply results for March 09, however, shows higher interruptions, which are due to the following reasons: -

- Starting of the first rains which normally strike with high speed winds in this region
- Some of the insulators newly used on few of these feeders as part of extension of line and replacement of deteriorated poles had developed cracks which have replaced later.
- Auto reclosures fixed on feeders DBF2 and DF5 are not working. Action has been initiated for compliance.

5. Cost Benefit Analysis

The investment made on these 15 auto reclosures is about Rs. 66 lakhs. This scheme has been proposed under network modernisation. The benefit in this particular project is by the way of improved customer satisfaction and improvement in reliability indices. The benefits of this project are largely tangible, as envisaged in the project report.

6. Conclusions

Encouraged by the results, Bescom would consider installation of more number of autos reclosures.

7. Guide lines for repeatability in other distribution areas

a) Benefits

Improved quality of supply (in terms of reduced number of interruptions) is the major benefit that the consumers would get by installation of auto reclosures. It also eases pressure on identification and rectification of faults by localizing the problems.

b) Challenges

There are no major challenges in execution of the project. There could be little or poor response from the bidders if the size the bid is small, which was the major difficulty faced while awarding the contract.

c) Key pitfalls/precautions

Since this is a pilot project, only 15 auto reclosures (at one for each identified feeder) were provided. Considering the length of the feeders, and the branch lines on each of the feeders, the number of auto reclosures provided is inadequate. At least 3 or 4 auto reclosures have to be provided on each feeder to effectively bring down the interruptions to an allowable level as per standards.

Though the equipment has the facility for remote operation through SCADA, the same is not being utilised in this project. This intervention will be more successful in this facility is effectively utilized.