INSTALLATION, SUPPLY AND QUALITY OF POWER SUPPLIED BY APSPDCL TO THE URBAN AND RURAL DOMESTIC CONSUMERS IN GUNTUR DISTRICT

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Abstract : An attempt is made in this paper to discuss about the power installation, supply and quality. It mostly covered the installation of electricity service in the house, time gap between the application and actual installation, problems in obtaining connection, daily availability of power, power cut, alternative source of power, opinion on quality of power supplied, fault metering, damage of electrical appliances etc. The study revealed that the installation of electricity in urban areas is started significantly in early years when compared with rural area. The urban respondents are getting electricity service a bite earlier than rural respondents. The urban respondents have more no. of hours of power per day then rural respondents. About 54.0 per cent of the urban respondents are possessing alternative source of power supply and 95.3 per cent of the rural respondents are not having any source of power supply. The APSPDCL are attending the supply faults within a day or 2 to 3 days in both urban and rural categories. Both respondents opined that power supply is having voltage problem and fluctuations in power. It is a healthy sign that majority of 73.6 per cent of the total respondents opined for non-damage of electrical appliance. But still few respondents suffered with poor quality of power. Damage and loss of electricity appliances due to poor quality of power supply is more in urban respondents when compared to rural respondents. The suffering of commercial consumers like education institutions, shopping mall and offices due to poor quality of powers always has a financial impact on their business, whereas the domestic consumers at the same time do suffer but may not have business loss.

IndexTerms **- Installation, consumers, voltage, quality, power.**

1.Introduction

India is all set to achieve 100 per cent household electrification by the month end 31st march 2019. About 2.44 crore families having receinal power connections out of the targeted 2.48 crore under the Rs.16,320 crore saubhagya sceme. The pradana mantri sahaj Bijci crban yojana (saubhagya) was launched in September 2017.

At a meeting of state power ministers, chaired by union Power Minister R K Singh in Shimla in July 2018, it was resolved to complete the task of energising all households by December 31, 2018, against the original deadline of March 31, 2019 provided under the Saubhagya scheme.

As per the official, the speed of work slowed down in some states due to elections and Maoist problems, while there were some contractual issues as well in a few states.

According to the Saubhagya portal, about 3.58 lakh households are left to be electrified in four states -- Assam (1,63,016), Rajasthan (88,219), Meghalaya (86,317) and Chhattisgarh (20,293)[1].

The Saubhagya scheme envisages providing last mile connectivity and electricity connections to all remaining households in rural as well as urban areas.

India's power system is facing a cute power crisis as the availability of power averagely on daily basis is in between 13-18 hours in almost all the states in India. Domestic and Commercial category is the major consumer of electricity in India. Making electricity available right from remote villages, small towns, suburban, urban areas to big metropolitan cities is always a great challenge to the power utilities and electricity suppliers. Moreover when the power sector is energy deficit the fulfillment of responsibility is below expectations of the consumers. The power system faces regular power cuts due to shutdown, burnout and tripping of transformers, voltage problems and grid failure. Inefficiency of the power system is affecting the customers. The power supply service to electricity consumers is not satisfactory. Consumers have started depending on alternate sources of power supply by DG (diesel generating) sets, invertors and home-ups. The diesel power generation in the country is growing at an alarming rate of 4 to 6 per cent.

Good power quality means steady supply voltage that stays within the prescribed range, smooth voltage curve wave form. In general, it is useful to consider power quality as the compatibility between what comes out of an electric outlet and the load that is plugged into it.[2] The term is used to describe electric power that drives an electrical load and the load's ability to function properly. Without the proper power, an electrical device (or load) may malfunction, fail prematurely or not operate at all. There are many ways in which electric power can be of poor quality and many more causes of such poor quality power.

The quality of electrical power may be described as a set of values of parameters, such as:

- Continuity of service (Whether the electrical power is subject to voltage drops or overages below or above a threshold level thereby causing blackouts or brownouts)[3]
- Variation in voltage magnitude (see below)
- Transient voltages and currents
- Harmonic content in the waveforms for AC power

The tolerance of data-processing equipment to voltage variations is often characterized by the CBEMA curve, which give the duration and magnitude of voltage variations that can be tolerated[4].

2.Objective

1. To study the process and procedures in installation, supply and quality of power supplied to domestic electricity consumers in Guntur district.

3.Hypotheses

$H0_1$: The opinion of the respondents from urban and rural areas has not varied on the installation of electricity service, problems of electrical appliances due poor quality of power.

$H0_2$: There is no difference between urban and rural respondents' opinion on frequent causes of power cut and poor quality of power supply.

4.Research methodology

This study is based on the primary data collected through structured questionnaire with related variables. The sample size of 740 respondents was chosen by using proportionate random sampling technique from among urban and rural domestic electricity consumers of Guntur district in Andhra Pradesh.

5.Analysis and results

A. Installation

5.1 Installation of the electricity service in the house

Table.no.5.1.Installation of electricity service in the house

Year		Consumer		
		Urban	Rural	Total
	Before 1985	81	12	93
		27.4%	2.7%	12.6%
	1986-90	91	71	162
		30.7%	16.0%	21.9%
	1991-1995	67	95	162
		22.6%	21.4%	21.9%
	1996-2000	11	92	103
		3.7%	20.7%	13.9%
	2001-2005	13	99	112
		4.4%	22.3%	15.1%
	2006-2010	15	51	66
		5.1%	11.5%	8.9%
	2011-2015	18	24	42
		6.1%	5.4%	5.7%
Total		296	444	740
		100.0%	100.0%	100.0%

Chi-Square: 186.594, P-Value: 0.000, Significant

Table no.5.1 gives the picture of installation of the electricity service in the house. An equal percentage of 21.9 per cent of the total respondents installed electricity service in their houses in between 1991-1995 and 1996-2000. The lowest 5.7 per cent of total sample respondents installed the service in between 2011-2015. Among urban respondents the highest majority of 30.7 per cent of them installed electricity service in between 1986-90 followed by before 1985 27.4 per cent, 1991-1995 22.6 per cent, 2011-2015 6.1 per cent, 2006-2010 5.1 per cent, 2001-2005 4.4 per cent and 1996-2000 3.7 per cent. As far as rural respondents are concerned the highest majority 22.3 per cent of them have installed the service in between 2001-2005 followed by 1991-1995 21.4 per cent, 1996-2000 20.7 per cent, 1986-90 16.0 per cent, 2006-2010 11.5 per cent, 2011-2015 5.4 per cent and before 1985 2.7 per cent.

The proportion of the respondents who were from the rural area is significant lesser for electricity installation before 1985 when compared with urban area respondents. Similarly the proportion of the respondents from rural area is significant higher after 2010 when compared with urban area respondents for electricity installation. The difference in the proportions is statistically significant at 5% level of significance as per the significant p-value of the chi-square test mentioned above. This will reveals that the installation of electricity service in urban area is started significantly in early years when compared with rural area. Hence the hypothesis is rejected and variables are dependent to each other.

5.2 Time gap between application and the actual installation of the electricity service

Table.no.5.2.respondents' opinion on time gap between application and actual installation of the electricity service

Days		Consumer		Total
		Urban	Rural	
	Below 10 days	62	13	75
		20.9%	2.9%	10.1%
	Between 10-20 days	147	46	193
		49.7%	10.4%	26.1%
	Between 21-30 days	51	126	177
		17.2%	28.4%	23.9%
	Between 31-40 days	15	228	243
		5.1%	51.4%	32.8%
	above 40 days	21	31	52
		7.1%	7.0%	7.0%
Total		296	444	740
		100.0%	100.0%	100.0%

Chi-Square: 287.161, P-Value: 0.000, Significant

Table no.5.2 describes the time gap between the application and the actual installation of service. Among the total sample respondents 32.8 per cent of the respondents revealed the time gap as 31-40 days, about 26.1 per cent of them told 10-20 days, 23.9 per cent of the respondents opined 21-30 days, 10.1 per cent of the respondents said below 10 days, whereas 7.0 per cent of them told above 40 days. As far as urban respondents are concerned the highest majority of 49.7 per cent of them revealed the time gap as 10-20 days and the lowest per cent is 5.1 for 31-40 days. Regarding rural respondents are concerned the highest majority of 51.4 per cent of them told the time gap as 31-40 days and lowest per cent is 2.9 for below 10 days.

It may be concluded that the urban respondents are getting electricity service a bite earlier than rural respondents.

As per the above table and the corresponding p-value of the chi-square test make a note that there is a significant time gap was observed between urban and rural areas for installation of electricity service after application received. In urban area, the time gap between application received by the electricity board and installation of meter is significantly lesser when compared with rural area. On the other hand it suggests significant association in the opinion of the respondents belonging to the two areas. Therefore the hypothesis is rejected.

5.3 Problems in obtaining electricity connection

Table.no.5.3.Respondents' opinion on the problem in obtaining electricity connection

Opinion		Consumer		Total
		Urban	Rural	
	Yes	111	155	266
		37.5%	34.9%	35.9%
	No	185	289	474
		62.5%	65.1%	64.1%
Total		296	444	740
		100.0%	100.0%	100.0%

Chi-Square: 0.472, P-Value: 0.482, Not Significant

Table no.5.3 portrays the problems in obtaining electricity connection. A highest majority of 64.1 per cent of the total sample respondents revealed no problem and the remaining 35.9 per cent of them told that they faced some problems. Regarding urban respondents a vast majority of 62.5 per cent said no problem and the balance 37.5 per cent of them faced some problems. As far as rural respondents are concerned a highest majority of 65.1 per cent told no problem and 34.9 per cent of them faced some problems in obtaining electricity connection.

From the table data it can be concluded that high majority of the respondents did not face any problem, but few respondents faced some problems.

Around 1/3rd of the respondents belonging from both the areas i.e., rural and urban is having problem in obtaining electricity connection in their house, whereas the remaining 2/3rd of the respondents are not facing any problem for getting the same. The difference in the proportions is not statistically significant as per the insignificant p-value of the chi-square test mentioned above. In other words there is no significant difference in the opinion of the total respondents on this aspect and it is supporting the hypothesis.

5.4 Problems faced in obtaining electricity connection

Table.no.5.4.Problems faced in obtaining electricity connection

S.No	Problems faced in obtaining electricity connection	Weighted Score(Rank)	
		Urban	Rural
1	Too many paper procedures	387(2)	535(2)
2	Meter not available	288(3)	421(3)
3	Too much personal pursuance	516(1)	663(1)
4	Installation of new transformer took lot of time	210(5)	365(4)
5	Transformer capacity is not sufficient	264(4)	323(5)

Table no.5.4 furnishes the problems faced by the respondents in obtaining electricity connection. Among the total sample respondents of 740 about 266 respondents faced the problem. The researcher further asked the 111 urban and 155 rural respondents about different problems they faced in getting electricity connection. The different problems have been given weighted scores and ranks. The urban and rural respondents gave same ranks for 1, 2 and 3 ranks. They gave first rank to too much personal pursuance, second rank for too many paper procedures and third rank to meter not available. A slight change in fourth and fifth ranks urban respondents gave fourth and rural respondents gave fifth rank to transformer capacity is not sufficient and urban respondents accorded fifth rank and rural respondents accorded fourth rank to installation of new transformer took lot of time.

It may be concluded that too much personal pursuance and too many paper procedures are the major problems faced by the total respondents in obtaining electricity connection.

B. SUPPLY

5.5 Daily availability of power in your area

Table.no.5.5.Respondents' opinion on daily availability of power in the area

Hours		Consumer		Total
		Urban	Rural	
	0-6 hrs	0	2	2
		.0%	.5%	.3%
	7-12 hrs	0	9	9
		.0%	2.0%	1.2%
	13-18 hrs	62	348	410
		20.9%	78.4%	55.4%
	19-24 hrs	234	85	319
		79.1%	19.1%	43.1%
Total		296	444	740
		100.0%	100.0%	100.0%

Daily availability of power is depicted in table no.5.5 A highest majority of 55.4 per cent of the total sample respondents told 13-18 hours, followed by 19-24 hours (43.1%), 7-12 hours (1.2%) and 0-6 hours (0.3%). Among the categories the urban respondents 79.1 per cent revealed that they have power in between 19-24 hours and 20.9 per cent of them told 13-18 hours, whereas a vast majority of 78.4 per cent of the rural respondents told 13-18 hours and 19.1 per cent of them revealed 19-24 hours. A negligible 2.0 per cent and 0.5 per cent of the respondents said 7-12 hours and 0-6 hours respectively.

The above table concludes that the urban respondents have more no. of hours of power per day than rural respondents. It is suggested to the APSPDCL authorities to increase the production of power and give more hours of power supply to rural areas.

The Researcher identified that the Energy Profile of India is not uniformly distributed across the country. Due to the nonexistent of an integrated power system grid connecting all the regions Eastern Region (ER), Northern Region (NR), North Eastern (NE), Western Region (WR) and Southern Region (SR) faced many problems of reducing planned and unplanned load shedding is not being resolved. Hence it is suggested to the government to expedite the formation of National GRID and 100 % linkages to all power stations to meet the power supply –demand gap and to provide power to both rural and urban areas for at least about 20 hours per day.

5.6 Frequencies of power cut due to various causes

A power outage also called a power cut, a power out, a power blackout, power failure or a blackout is a short-term or a long-term loss of the electric power to a particular area.

There are many causes of power failures in an electricity network. Examples of these causes include faults at power stations, damage to electric transmission lines, substations or other parts of the distribution system, a short circuit, or the overloading of electricity mains.

Types of power cut

Power cut are categorized into three different phenomena, relating to the duration and effect of the outage:

- A permanent fault is a massive loss of power typically caused by a fault on a power line. Power is automatically restored once the fault is cleared.
- A brownout is a drop in voltage in an electrical power supply. The term brownout comes from the dimming experienced by lighting when the voltage sags. Brownouts can cause poor performance of equipment or even incorrect operation.
- A blackout is the total loss of power to an area and is the most severe form of power outage that can occur. Blackouts which result from or result in power stations tripping are particularly difficult to recover from quickly. Outages may last from a few minutes to a few weeks depending on the nature of the blackout and the configuration of the electrical network.
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Table.no.5.6.Respondents' opinion on power cut due to various causes

Sr. No.	Causes for power cut	Very Frequently	Frequently	Occasionally	Rarely	No opinion
1	Shut down of sub –stations	43(5.8%)	59(8%)	156(21.1%)	401(54.2%)	81(10.9%)
2	Burn out of transformers due to over load	34(4.6%)	65(8.8%)	146(19.7%)	289(39.1%)	206(27.8%)
3	Tripping of transformers due to over load	139(18.8%)	81(10.9%)	95(12.8%)	388(52.4%)	37(5%)
4	Other causes of transformers failure	45(6.1%)	58(7.8%)	129(17.4%)	334(45.1%)	174(23.5%)
5	Voltage problem	75(10.1%)	191(25.8%)	130(17.6%)	280(37.8%)	64(8.6%)

Respondents' opinion on frequencies of power cut due to various causes is portrayed in table no5.6. Very frequently shutting down of sub stations is the minor cause recorded by 5.8 per cent and major cause is rarely it is recorded 54.2 per cent. Burn out of transformer due to over load is the major cause 39.0 per cent rarely and minor is very frequently 4.6 per cent. Regarding tripping of transformers due to over load major cause is rarely 52.4 per cent and minor 10.9 per cent frequently. Other causes of transformers failure major cause is 45.1 per cent rarely and minor cause 6.1 per cent very frequently, whereas voltage problem major cause is 37.8 per cent rarely and minor cause 10.1 per cent reported by the respondents.
The above analysis gives a strong inference that inaddition to the power crisis, the poor performance and unappreciable maintenance of the power equipments the distribution system i.e. APSPDCL is unable to provide uninterrupted power supply.

Table no.5.6a Respondents' opinion on power cut due to various causes

S.No.	Causes for power cut	Consumer	n	Mean	SD	T-Value	P-Value	Decision
1	Shut down of sub –stations	Urban	296	2.19	0.76	-5.73	0.000	S
		Rural	444	2.60	1.08			
2	Burn out of transformers due to over load	Urban	296	2.01	1.26	-4.591	0.000	S
		Rural	444	2.38	0.94			
3	Tripping of transformers due to over load	Urban	296	3.52	1.31	12.95	0.000	S
		Rural	444	2.42	0.99			
4	Other causes of transformers failure	Urban	296	2.43	0.92	3.01	0.003	S
		Rural	444	2.18	1.18			
5	Voltage problem	Urban	296	2.88	1.33	-0.523	0.601	NS
		Rural	444	2.93	1.06			

The above table explains about the respondents' causes for power cut by both types of consumers. Expect for the voltage problem, the average opinion scores of all causes are below 2.5 i.e., these causes are just above the rarely happened. Further, the average opinion score of rural consumers for the causes "Shut down of sub –stations" and "Burn out of transformers due to over

load" is significantly more when compared with urban area i.e., for rural area, shut downs and burnout of transformers are more which causing for the power cut, whereas in the urban area, the tripping of transformers due to over load and other causes of transformers failures are significantly more when compared with rural area as per the significant p-value of the student t-test mentioned above. For the statement "Voltage problem", the average opinion score of rural and urban respondents are very close to each other and the score is just closer to "3" i.e., for both the areas the voltage problems are occasionally happened. Decision for all the causes is significant except one cause. It suggests association between the variables and type of respondents. Thus it is not supporting the hypothesis. For voltage problem the hypothesis is accept and the variables are independent to each other.

5.7 Alternative source of power supply

Table.no.5.7.Respondents' opinion on alternative source of power supply

Alternative sources		Consumer		
		Urban	Rural	Total
	Inverters	157	21	178
		53.0%	4.7%	24.1%
	Home-UPS	3	0	3
		1.0%	.0%	.4%
	No Source	136	423	559
		45.9%	95.3%	75.5%
Total		296	444	740
		100.0%	100.0%	100.0%

The researcher asked the respondents about alternative sources of power supply and the data is given in table no.5.7. Out of 740 total sample respondents about 559 (75.5%) of them do not have any alternative source of power supply. About 178 (24.1%) of the respondents are using inverters as an alternative source of power supply. Regarding urban respondents a highest majority of 53.0 per cent of them is having inverters and 1.0 per cent of them are using Home-UPS. About 45.9 per cent of them are not having any sources of power supply. Coming to rural respondents a whopping majority of 95.3 per cent of them doesn't possess any alternative sources of power supply and 4.7 per cent of them are using inverters.

It may be concluded that 54.0 per cent of the urban respondents are possessing alternative source of power supply, whereas 95.3 per cent of the rural respondents are not having any source of power supply. The researcher identified that because of power shortage, diesel power generation in India is increasing at 4-5 per cent national growth rate, which is very much in line, with the above table conclusion. It is suggested to the government to expedite projects in renewable energy segment as India has great potential for wind and solar energy creating and giving equal opportunity to all the players in the power sector.

5.8 Time taken by APSPDCL to attend the supply faults

Table.no.5.8.Respondents' opinion on attending the supply faults by the APSPDCL

Days		Consumer		
		Urban	Rural	Total
	Within a day	105	83	188
		35.5%	18.7%	25.4%
	2 to 3 days	191	322	513
		64.5%	72.5%	69.3%
	4 to 5 days	0	32	32
		.0%	7.2%	4.3%
	above 5 days	0	7	7
		.0%	1.6%	.9%
Total		296	444	740
		100.0%	100.0%	100.0%

A vast majority of 69.3 per cent of the total sample respondents told that the APSPDCL took 2 to 3 days to attend the supply faults. About 25.4 per cent of the respondents revealed that within a day the APSPDCL attend the supply faults. A negligible per cent of 4.3 per cent and 0.9 per cent of them told 4 to 5 days and above 5 days respectively. Regarding the category of urban respondents of 64.5 per cent told 2 to 3 days and 35.5 per cent said within one day the supply faults are rectified, whereas 72.5 per cent of rural respondents told 2 to 3 days and 18.7 per cent said within a day the faults are rectified. (Table no5.8)

At the outset it may be concluded that the APSPDCL are attending the supply faults within a day or 2 to 3 days in both the urban and rural categories.

5.9 Electricity supply position

The respondents were asked about the electricity supply position before 2005 and after 2005. Their opinions are furnished in tables no. 5.9 and5. 9a.

Table no.5.9.Respondents' opinion on electricity supply position before 2005

Opinion		Consumer		
		Urban	Rural	Total
	Better	0	16	16
		.0%	3.6%	2.2%
	Satisfactory	6	17	23
		2.0%	3.8%	3.1%
	Poor	66	92	158
		22.3%	20.7%	21.4%
	Low Voltage	10	50	60
		3.4%	11.3%	8.1%
	High Voltage	20	42	62
		6.8%	9.5%	8.4%
	High Frequent power cuts	194	227	421
		65.5%	51.1%	56.9%
Total		296	444	740
		100.0%	100.0%	100.0%

Electricity supply position before 2005 is revealed in table no.5.9. A highest majority of the total sample respondents (56.9%), urban respondents (65.5%) and rural respondents (51.1%) told high frequent power cuts. Regarding poor supply of electricity urban respondents are (22.3%), total respondents (21.4%) and rural respondents (20.7%). Whereas for high voltage rural respondents revealed (9.5%), total respondents (8.4%) and urban respondents (6.8%). Regarding low voltage rural respondents opined (11.3%), total (8.1%) and urban respondents (3.4%). Respondents' opinion on satisfaction of electricity supply position before 2005 negligible percentages is recorded for rural respondents (3.8%), total respondents (3.1%) and urban respondents (2.0%).

Table no.5.9a.Respondents' opinion on electricity supply position after 2005

Opinion		Consumer		
		Urban	Rural	Total
	Better	165	181	346
		55.7%	40.8%	46.8%
	Satisfactory	128	240	368
		43.2%	54.1%	49.7%
	Poor	0	2	2
		.0%	.5%	.3%
	Low Voltage	0	2	2
		.0%	.5%	.3%
	High Voltage	0	15	15
		.0%	3.4%	2.0%
	High Frequent power cuts	3	4	7
		1.0%	.9%	.9%
Total		296	444	740
		100.0%	100.0%	100.0%

Electricity supply position after 2005 is described in table no.5.9a. A little less than 50.0 per cent of the total respondents are satisfied with supply position after 2005and 46.8 per cent told that it is better now. Regarding urban respondents 55.7 per cent of them told better and 43.2 per cent said that they are satisfied with the power supply after 2005. As far as rural respondents are concerned a highest majority of 54.1 per cent of them is satisfied and 40.8 per cent told it is better. Regarding poor supply, low voltage, high voltage and frequent power cuts all the respondents gave negligible percentages.

According to the opinion of the respondents it may be concluded that there is a drastic changes in electricity supply position after 2005. It has improved a lot because of the enactment of several Electricity Acts. About 55.7 per cent of the urban respondents told better and 54.1 per cent of the rural respondents and 49.3 per cent of total respondents are satisfied with supply position after 2005.

C. QUALITY

The power supply quality and reliability is a chronic problem in the power system. The reforms could bring changes in managerial and administrative controls of the state owned organizations delivering electricity services but failed to improve the shortages in power supply, efficiency in operation, quality of power, operation and maintenance, metering and billing system. Consumers both in the domestic as well as commercial are suffering from poor quality of power supply damaging their home appliances and electrical equipments. Commercial consumers lose potential business hours daily due to power cuts and voltage problems. Consumers grievances related to loss of damages and electrical safety both at residential and commercial establishments need immediate attention by the authorities.

As a bird cannot fly with single wing, similarly India's Power Sector with its two wings one being the Power Utilities and other Electricity Consumers cannot fly to success unless both of them are in complete harmony with each other.

Monitoring the performance of electric utilities is becoming very essential and it is high time that performance benchmarking approach has not been defined and developed reflecting major key performance indices (KPIs) in the day to day operations of the power utility including technical, operational and financial.

5.10 Quality of power supplied daily

Table.no.5.10.Respondents' opinion on quality of power supplied daily

Sr. No	Power quality	Yes	No
1	Low voltage	267(36.1%)	473(63.9%)
2	High voltage	133(18%)	607(82%)
3	Normal voltage	703(95%)	37(5%)
4	Fluctuations	287(38.8%)	453(61.2%)
5	Frequencies	169(22.8%)	571(77.2%)

Respondents' opinion on quality of power supplied daily is given in table no.5.10. Normal voltage was reported by 95.0 per cent of the total sample respondents, followed by fluctuations (38.8%), low voltage (36.1%), frequencies (22.8%) and high voltage (18.0%).

It is evident from the above table that power supply is having voltage problem and fluctuations between low and high voltage throughout the day. It is suggested that power distribution system APSPDCL should improve its power supply regulation with a normal voltage which will help the consumers to protect their electrical equipments from damaging.

5.11 Facing fault in the metering system

An electricity meter is a device that measures the amount of electric energy consumed by a residence, a business, or an electrically powered device.

Electric utilities use electric meters installed at customers' premises for billing purposes. They are typically calibrated in billing units, the most common one being the kilowatt hour (*kWh*). They are usually read once each billing period.

When energy savings during certain periods are desired, some meters may measure demand, the maximum use of power in some interval. "Time of day" metering allows electric rates to be changed during a day, to record usage during peak high-cost periods and off-peak, lower-cost, periods. Also, in some areas meters have relays for demand response load shedding during peak load periods.[5]

Table.no.5.11.Respondents' opinion on facing fault in the metering system

Sr. No	Meter faults	Very Frequently	Frequently	Occasionally	Rarely	No
1	Meter not working with connected load	3(0.4%)	92(12.4%)	183(24.7%)	173(23.4%)	289(39.1%)
2	Meter working without connected load	5(0.7%)	23(3.1%)	244(33%)	178(24.1%)	290(39.2%)
3	Tripping of meters due to over load	2(0.3%)	9(1.2%)	120(16.2%)	493(66.6%)	116(15.7%)
4	Meter reading not proportionate with energy consumption	7(0.9%)	27(3.6%)	220(29.7%)	287(38.8%)	199(26.9%)

Respondents' opinion on facing fault in the metering system is furnished in table no.5.11. About 24.7 per cent and 12.4 per cent of the total sample respondents complained for occasionally and frequently fault of meter not working with connected load, whereas 33.0 per cent of them told that meter working without connected load. A vast majority of 66.6 per cent of the total respondents opined rarely that the meter is tripping due to over load. And 38.8 per cent of them complained that meter reading is not proportionate with energy consumption.

At the outset it may be concluded that the total sample respondents are facing occasionally and rarely fault in the metering system. It is suggested that the electricity authorities to rectify the metering faults to bring it to zero fault.

5.12 Damage and loss of electrical appliances due to poor quality of power

Table.no.5.12.Damage and loss of electricity appliances due to poor quality of power supply in recent years

Opinion		Consumer		Total
		Urban	Rural	
	Yes	110	85	195
		37.2%	19.1%	26.4%
	No	186	359	545
		62.8%	80.9%	73.6%
Total		296	444	740
		100.0%	100.0%	100.0%

Chi-Square: 29.709, P-Value: 0.000, Significant

Damage and loss of electrical appliances due to poor quality of power is detailed in table no.5.12. The category wise analysis shows that 62.8 per cent urban respondents and 80.9 per cent rural respondents said no for damage and loss of electrical appliances, whereas the balance 37.2 per cent urban and 19.1 per cent rural respondents complained that there is a damage and loss of electrical appliances due to poor quality of power.

It is a healthy sign that majority of 73.6 per cent of the total respondents opined for non-damage of electrical appliance. But still few respondents suffered with poor quality of power. Hence it is suggested to improve the performance of APSPDCL distribution utility in order to provide good quality of power supply to minimize and avoid damage and loss of electrical appliances of the consumers.

Damage and loss of electricity appliances due to poor quality of power supply is more in urban respondents when compared to rural respondents. The generated P-value 0.000 is found to be significant at 0.05% level. The hypothesis is rejected and variables are dependent to each other.

5.13 Consumers who suffered because of poor quality of power supply

Table.no.5.13.Effect of poor quality of power supply on consumers

Sr. No	Electrical Energy Consumers	Major	Moderate	Minor	No opinion
1	Educational institutions	264(35.7%)	170(23%)	166(22.4%)	140(18.9%)
2	Shopping malls	375(50.7%)	229(30.9%)	37(5%)	99(13.4%)
3	Offices	353(47.7%)	243(32.8%)	41(5.5%)	103(13.9%)
4	Residential	345(46.6%)	294(39.7%)	30(4.1%)	71(9.6%)

Consumers affected because of poor quality of power supply are denoted in table no.5.13. Shopping malls (50.7%), offices (47.7%), residential (46.6%) and educational institutions (35.7%) are the major sufferers and are affected by poor quality of power supply. Regarding moderate suffering residential consumers are (39.7%), offices (32.8%), shopping malls (30.9%) and educational institutions (23.0%). Less percentage is recorded to minor and no opinion options.

The suffering of commercial consumers always has a financial impact on their business, whereas the domestic consumers at the same time do suffer but may not have business loss. Therefore the sufferings of the electrical energy consumers like educational institutions, shopping malls, offices and residential will differ from major, moderate to minor accordingly. However it can be concluded from the above table that on an average 45.0 per cent of the consumers are suffering because of poor quality of power supply.

Table.no.5.13a.Effect of poor quality of power supply on consumers

S No.	Electrical Energy Consumers	Consumer	n	Mean	SD	T-Value	P-Value	Decision
1	Educational institutions	Urban	296	2.48	0.94	-5.422	.000	S
		Rural	444	2.93	1.21			
2	Shopping malls	Urban	296	3.25	1.09	1.241	.215	NS
		Rural	444	3.15	0.98			
3	Offices	Urban	296	3.04	1.08	-2.211	.027	S
		Rural	444	3.21	1.00			
4	Residential	Urban	296	2.85	1.04	-9.872	.000	S
		Rural	444	3.49	0.72			

The above table clearly explains the suffering by the different types of institutions, offices, shopping malls and residential due to poor quality of power supply with regard to the type of consumer. The average opinion scores of the four categories consumers are close to "3" i.e., close to moderate level. A significant majority of the respondents from rural area opined that they are suffering from poor quality of power supply and it effects significantly more on residence followed by offices and educational institutions and these scores are significantly more than the urban area respondents, whereas in shopping malls the average opinion scores of both rural and urban respondents is very close to each other at 5% level of significance as per the insignificant p-value of the student t-test mentioned above. Thus the hypothesis is accepted and the variables are independent to each other. For other consumers' hypothesis rejected and the variables are dependent to each other

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