

# **Electrical Energy Consumption in Over Exploited Regions of East Godavari District**

**K.V.S. Ramachandra Murthy and G. V. Phanindra**

**ABSTRACT:** In this paper, Electrical Energy Consumption in Agricultural Sector is analysed. Over exploited regions of East Godavari District were chosen for analysis. The electrical energy consumption data and number of pump sets of these regions for the four years (2006-07 to 2009-10) were collected from Andhra Pradesh Eastern Power Distribution Corporation Ltd., (APEPDCL). Total irrigated area during Rabi season of 2006-07 under various crops was collected from Andhra Pradesh Directorate of Statistics and Economics. Sources of water were identified under each of these regions. Electrical Energy required for agricultural purpose was estimated. Estimated Energy consumption is compared with actual energy consumed by these regions. A large gap is observed between actual and estimated consumptions. Reasons for excess consumption of electrical energy were presented. Suggestions for saving electrical energy as well as underground water are made in this work. The issues like, total number of pump sets, total load connected, total energy consumed by agricultural pumps, average consumption per pump motor, annual energy consumption per one HP of the pump capacity are addressed based on the practical data

## **I. INTRODUCTION**

In Andhra Pradesh the agricultural sector consumption accounts for 37.45% which is slightly less than National Average. On the national level average load is taken as 6.5 kW per pump set and 1800 pumping hours per year. Normally, 5HP, 7.5HP, 10HP, 12.5 HP motors are connected for Agricultural purposes based on size of the irrigated area. Assessment of average connected load of the each pump set is very important factor in estimating the total energy supplied to this sector as all services are not metered in any state in India. Number of operating hours is also not uniform in all states because of the imbalances in power generation and loading patterns.

K. V. S. Ramachandra Murthy is working as Associate Professor in the Department of E.E.E. at G.V.P. College of Engineering, Visakhapatnam, India.

G. V. Phanindra is pursuing M. Tech in Power System Control and Automation in the Department of E.E.E., G.V.P. College of Engineering, Visakhapatnam, India

Contribution of Agricultural sector in total electricity consumption is about 40% in India. The electricity saving potential is also very high in Agricultural pumps. Different studies show different picture for agricultural power consumption because of subsidized nature of the agricultural sector, and also due to free supply of power in many states, there is no proper metering for the energy supplied to this sector. So all the estimates will not give same results. The consumption in this sector needs to be reviewed in large scale.

In India the agricultural pump sets were connected to open wells and people were using either 3 HP or 5 HP pump sets earlier. Since the water table has fallen below 500 feet in some localities and all most all the open wells have dried up, and farmers are forced to use higher rated pumps. In the present situation, the average connected load per pump will be certainly higher than 5 kW. Also in many Indian states, for agricultural pumps, the tariff is collected based on the HP of the pump. So people change the name plate details and show lower HP rating. A sample survey indicates that the average connected load of the new pumps will be 6.5 kW per pump. The electricity saving potential is very high in Agricultural pumps. This sector needs to be reviewed. Different studies show the different picture for agricultural power consumption. In the agricultural sector, power is supplied on subsidy in many states and power is supplied free of cost in some states. There is no proper metering for the energy supplied to this sector. So all estimates will not give same results.

The issues like, total number of pump sets, total load connected, total energy consumed by agricultural pumps, average consumption per pump motor, annual energy consumption per one HP of the pump capacity are addressed based on the practical data. The analysis from Mandal Level is carried out in this work.

## **II. STUDIES CARRIED OUT**

Over exploited basins of East Godavari district of Andhra Pradesh are analysed. The data of over exploited basins is obtained from Central Ground Water Board report of 2008. Eleven mandals of East Godavari were identified as over exploited mandals. In these mandals, more than 90% of the ground water recharged is extracted through pumping. 37 wells were analysed by Central Ground Water Board in East

Godavari across various mandals in May, 2010. According to their report, the minimum depth of water table is 0.43 meters below ground level and maximum depth of water table is 9.94 metres below ground level. The electrical energy consumption data, total cropped area and number of pump sets of these mandals for the four years (2006-07 to 2009-10) were collected and analyzed. Table I presents Electrical Energy consumption on Agricultural Feeders in over exploited mandals of East Godavari District in Andhra Pradesh. Table II presents area under Paddy crop in Rabi and Kharif of 2006-07 year. Table III presents area under non-

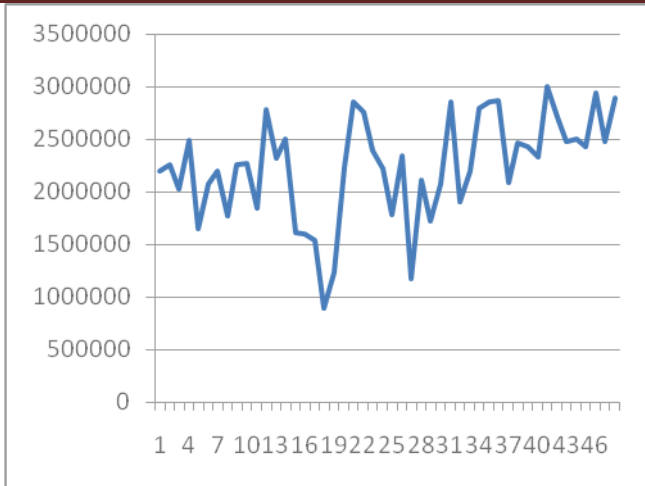
paddy crop in over exploited mandals in Rabi season. Table IV presents rain fall in different years in East Godavari district. Table V presents area irrigated source wise and mandal wise during the year 2006-07. Table VI presents the number of pump sets and total hp connected as on march, 2010 in over exploited mandals of East Godavari District. Table VII presents consumption per hp of the pump motor for the April month in different years.

**TABLE 1: ELECTRICAL ENERGY CONSUMPTION ON AGRICULTURAL FEEDERS IN OVER EXPLOITED MANDALS OF EAST GODAVARI DISTRICT**

S. No.	Name of the Mandal	Electrical Energy Consumption for different years ( Million Units)			
		2006-07	2007-08	2008-09	2009-10
1	Anaparthi	5.474	3.067	4.973	6.22
2	Biccavolu	9.322	8.649	9.343	10.2
<b>3</b>	<b>Gandepalli</b>	<b>25.863</b>	<b>24.211</b>	<b>26.766</b>	<b>30.82</b>
4	Kadium	9.451	8.214	8.013	12.393
5	Korukonda	10.743	9.297	6.253	9.27
6	Pithapuram	4.625	4.904	7.181	12.411
7	Rajahmundry(Rural)	5.983	6.054	5.975	8.827
<b>8</b>	<b>Rajanagaram</b>	<b>24.329</b>	<b>21.686</b>	<b>23.539</b>	<b>28.93</b>
9	Rangampeta	14.277	13.399	13.986	16.156
10	Seetanagaram	4.665	5.325	3.093	8.661
11	Tondangi	10.525	11.97	12.604	13.891

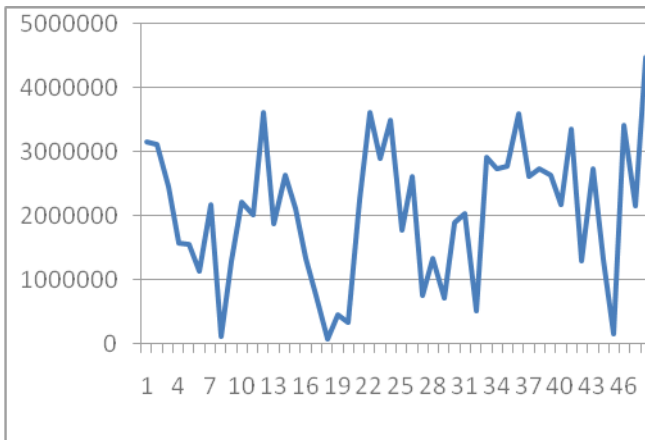
Observations : Monthly consumptions for 48 months from 2006-07 to 2009-10 were plotted for two mandals which have very high consumption levels. They are Gandepalli and Rajanagaram. Data from April, 2006 to March, 2010 were

plotted to observe the variations. Fig. 1 shows monthly consumptions of Gandepalli mandal and Fig. 2 is of Rajaganaragam mandal.



Y-Axis: kWh consumption; X-48 months from April, 2006 to March, 2010.

Fig.1. Monthly consumption for four years from April, 2006 to March, 2010 (48 months) of Gandepalli Mandal.



Y-Axis : kWh consumption; X-48 months from April, 2006 to March, 2010.

Fig. 2. Monthly consumption for four years from April, 2006 to March, 2010 of Rajanagaram Mandal:

Observations : Minimum monthly consumptions were observed in East Godavari during four financial years in November, 2006; September, 2007; June, 2008 and April, 2009 respectively. Wide variations can be observed in the graph also. Maximum monthly consumptions were

observed in East Godavari during four financial years in March, 2007; January, 2008; January, 2009 and March, 2010 respectively. Maximum and minimum energy consumptions vary depending up on the rainfall.

TABLE II : AREA UNDER PADDY DURING 2006-07 IN OVER EXPLOITED MANDALS

S. No.	Name of the Mandal	Area Under Paddy during 2006-07 in Hectares		
		Kharif	Rabi	Total
1	Anaparthi	4127	3941	8068
2	Biccavolu	6530	5683	12213
3	Gandepalli	3376	274	3650
4	Kadium	3003	2508	5511
5	Korukonda	5437	92	5529
6	Pithapuram	7074	6913	13987
7	Rajahmundry(Rural)	1361	575	1936
8	Rajanagaram	6066	1831	7897
9	Rangampeta	3655	268	3923
10	Sitanagaram	4766	79	4845
11	Tondangi	4136	1120	5256

TABLE III : AREA UNDER NON- PADDY CROPS DURING 2006-07 IN OVER EXPLOITED MANDALS :

S. No.	Name of the Mandal	Area Under other crops during 2006-07 during Rabi season (in Hectares)		
		Green Gram	Black Gram	Sugarcane
1	Anaparthi	866	728	15
2	Biccavolu	2424	1915	102
3	Gandepalli	289	216	1121
4	Kadium	567	1308	825

5	Korukonda	410	805	547
6	Pithapuram	4392	342	1066
7	Rajahmundry(Rural)	25	90	595
8	Rajanagaram	232	324	518
9	Rangampeta	224	1252	667
10	Sitanagaram	367	372	756
11	Tondangi	450	450	-

2600 hectares during Rabi season of 2006-07. As the remaining crops grown in various mandals are very marginal, they are not presented here.

Observations from Table III : Sugarcane is one crop which is also irrigated during Kharif also. The Table IV is presented to highlight the fact that during Rabi, Electrical Energy is consumed heavily for non-paddy crops also. In Sitanagaram Mandal, paddy is cropped in only 79 hectares during Rabi. But, the other crops are cultivated in large area of 1495 hectares. Rainfall in different financial years and corresponding deviations from normal rainfall are presented in Table IV. The deviations in rainfall has direct impact on electrical energy consumption in different years.

Observations from Table II: In Sitanagaram mandal, paddy is cropped in only 79 hectares but, Maize is cultivated in

TABLE IV : YEAR WISE RAINFALL IN EAST GODAVARI DISTRICT

Year	Normal Rainfall	2004-05	2005-06	2006-07	2007-08	2008-09
Rainfall	1219	873	1389	1167	1404.6	1035.1
Deviations	-	- 28%	+14%	-4%	+15%	-15%

It is observed that rainfall was good during 2007-08 which resulted in drastic reduction in electrical energy consumption Table-I in all mandals. During 2006-07, improved

production is observed though, a little decrease (-4%) in rain fall and for 5% increase in area cropped.

TABLE V: AREA IRRIGATED MANDAL WISE, SOURCE WISE DURING 2006-07 (IN HECTARES)

S. No.	Over Exploited Mandal	Canals	Tanks	Lift	Tube wells	Total
1	Anaparthi	6939	255	--	985	8179
2	Biccavolu	9556	980	56	1828	12420
<b>3</b>	<b>Gandepalli</b>	<b>-</b>	<b>2200</b>	<b>--</b>	<b>5095</b>	<b>7295</b>
4	Kadium	3885	85	298	6003	10271
5	Korukonda	-	2326	1091	3665	7122
<b>6</b>	<b>Pithapuram</b>	<b>16079</b>	<b>--</b>	<b>--</b>	<b>861</b>	<b>16940</b>

7	Rajahmundry(Rural)	5	178	874	2796	3853
<b>8</b>	<b>Rajanagaram</b>	--	<b>1141</b>	<b>2178</b>	<b>8189</b>	<b>11751</b>
9	Rangampeta	--	1485	863	2926	5274
<b>10</b>	<b>Sitanagaram</b>	--	--	<b>3123</b>	<b>7127</b>	<b>10250</b>
11	Tondangi	2267	2232	--	1625	6124
	TOTAL	38731	10882	8483	41100	99479
	Percentage	38.93%	10.93%	8.52%	41.31%	100%

Observations from Table V : Gandepalli and Rajanagaram recorded very high energy consumption in Table I, as there is no canal facility in both the mandals. Canals would be supplying water during Kharif season. During Rabi, those crops majorly depend on tube wells. In Pithapuram and Seetanagaram, irrigation is not supported by tanks at all. It is observed that 41.31% irrigation is dependent on Tube wells during Kharif also. Lift irrigation is used in Sitanagaram, Rajanagaram, Korukonda, Rajahmundry, and Rangampeta mandals out of the over exploited basins. Canal irrigation is possible only in Pithapuram, Bikkavolu, Anaparthi, Kadium and Tondangi mandals in the decreasing order.

Observations from Table VI: In the decreasing order of energy consumption, the mandals are Rajanagaram, Gandepalli, Kadium, Rangam pet, Tondangi, Pithapuram, Rajahmundry(rural), Sitanagaram. Important observation is that in all the over exploited mandals of East Godavari District, the average pump rating is above the national average of 8.73 HP. Except at Seetanagaram mandal, Korukonda and Kadium. Kadium is dominated by horticulture which consists of more number of small size pumps. The highest in average rating of the pump is in Rajanagaram Mandal where very high consumption is observed.

There is a need to put some limit on the size of the pumps, number of the pumps or on the amount of consumption to limit the drastic fall in the water table.

**TABLE VI: THE NUMBER OF PUMP SETS AND TOTAL HP CONNECTED AS ON MARCH, 2010 IN OVER EXPLOITED MANDALS OF EAST GODAVARI**

S. NO.	Mandal	Number of pump sets	Total HP	Avg rating of pump
1	Anaparthi	414	3685	8.90
2	Biccavolu	485	5683	11.71
3	Gandepalli	1441	17484	12.13
4	Kadium	2280	12356	5.41
5	Korukonda	1453	10461	7.19
6	Pithapuram	924	8258	8.93
7	Rajahmundry(Rural)	737	8097	10.9
8	Rajanagaram	1622	24362	15.01
9	Rangampeta	646	9433	14.6
10	Seetanagaram	977	7555	7.73
11	Tondangi	916	8336	9.10

**TABLE VII: CONSUMPTION PER HP OF THE MOTOR FOR THE APRIL MONTH IN DIFFERENT YEARS**

S. No.	Mandal	April, '06	April, '07	April, 08	April, 09	March, 10
1	Anaparthi	73.	51	117	116	154
2	Biccavolu	94	154	150	152	154
3	Gandepalli	125	133	102	120	166
4	Kadium	127	48	82	118	193
5	Korukonda	139	71	70	141	194
6	Pithapuram	61	30	41	130	156
7	Rajahmundry(Rural)	138	88	68	84	192
8	Rajanagaram	126	76	73	107	183
9	Rangampeta	127	132	101	122	165
10	Seetanagaram	130	46	31	114	194
11	Tondangi	115.6	128	96	126	172

Table VIII : ELECTRICAL ENERGY CONSUMPTION FOR OVER EXPLOITED MANDALS IN RABBI SEASON

FOR YEAR (2006-07):

9	Rangampeta	5.830532	0.584
10	Seetanagaram	1.526673	0.396
11	Tondangi	4.605955	0.412

S. N O	Mandals	Actual consumption(M. U) during Rabi season	Calculated Consumption (M.U)
1	Anaparthi	2.160594	1.245
2	Bikkavolu	4.723501	0.874
3	Gandepalli	10.94949	0.646
4	Kadium	3.227056	1.412
5	Korukonda	3.903373	0.416
6	Pithapuram	1.632733	0.3
7	Rajahmundry (Rural)	2.604768	0.472
8	Rajanagaram	9.219238	1.112

Observations from Table VIII : There is a large gap in the energy required to supply water for agricultural sector. The calculation is made in such a way that major portion of the water is drawn from tanks and tube wells. i.e., Canal irrigation is assumed marginal. Still, we find a large gap between the energy estimated and supplied by Utility.

### CONCLUSIONS

The analysis of electrical energy consumption in over exploited mandals of East Godavari were carried out. By considering the crop pattern, sources of water available, electrical energy requirement was estimated. It is compared with actual energy consumed as reported by APEPDCL. Reason for over consumption is that the electrical energy is supplied free of cost and no co-ordination between agricultural department, irrigation department and state electrical utility. Farmer is least bothered about drastic fall in

the water table and misuse of electrical energy which is supplied free of cost to him. The issues like average HP of pump motor, energy consumed per HP of pump motor are also presented in this paper for the over exploited mandals to compare it with the national figures. There is a dire need to put some limit on the number of pumps, size of the pump motor and energy consumption made by the agricultural pumps to limit drastic fall in the water table.

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