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AN ANALYTICAL STUDY OF THE INFLUENCE ON DOMESTIC CONSUMERS IN KARNATAKA BY TIME-OF-DAY TARIFF

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Abstract: Domestic customers in current times have been provided with the opening to choose from a wide diversity of tariff structures with the implementation of smart metering. But the suppliers are not yet sure about what strategy to be addressed to which kind of customers. This paper brings forth one such up to date tariff structure- Time-of-Day tariff. It is based on the smart metering consumption data provided by Karnataka Power Transmission Corporation Limited on their website. The local topological features have been kept in mind while scheming average load curves for various seasons. The resultant load curves have been analyzed and a statistical directive is grant as to how the execution of this type of tariff arrangement can gain both the domestic customers as well as to sustain system stability.

Keywords: Time slabs, time-of-day tariff, all electric housing, non- all electric housing.

I. INTRODUCTION

Tariff refers to the amount of money the consumer has to pay for making the power available to them at their homes. Tariff scheme takes into account various factors to compute the total cost of the power. Time of Use tariff is based on a idea where the daily life of the consumer is kept into concern, after which an study leads us to frame a tariff design which provides more flexibility to the consumer and as a result also benefits the entire phase of the Electricity market. If you are qualified and desire a flexible pricing offer, different power rates will affect depending on the time of day. India is a country where this exceptional tariff has not been widely put into produce and so a state in it has been taken for this model pricing job. The basic idea is to afford the domestic customers a choice to decrease their electricity plan by managing it efficiently and smartly. The different period of the day will be alienated into various parts based on different pricing of electricity. The household customer desires to take

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care so that they can use most of their lofty consuming equipments at a time when the price is low down.

II. LITARATURE SURVEY

The modern day household buyer in India frequently pays for electricity in the following format: - F.C. = R*MDI+P.F.*R*(MDI-S).

Where, F.C. = Total fixed charge that is billed to the consumer.

R = Rate mentioned as fixed charge/KW load for the bill period.

MDI = Maximum load of the consumer in the bill cycle.

P.F. = Penalty factor applicable for using the additional load.

S = Sanctioned/registered load with the utility.

2.1. Short coming:

Power lack arises at high demand period of the day due to be short of substitute strategies to offset this problem successfully. The household buyer in a permanent plan this looks at the bill as a monthly product and not as a daily one. There is no satisfying response accessible for sensible consumers with power saving principles. By 2010, India was invented to growth from the sixth to the fourth largest buyer of energy, after the USA, China and Japan. Therefore it is a exact weakness that such a vast market lacks flexibility to such a great level as most household customers are not even made alert that such an alternative exists which could be deeply towards their benefit.

2.2. Benefits of Implementing Time-Of-Day Tariff:

The benefits of implementing the time of use tariff formation inside Indian there is the situation like: It will offer possibility for consciousness concerning power saving to the household customers. It reduces the electricity bills for household customers and also adds to the earnings scope of suppliers. It will assist save power from the household usage to be prepared available for Industrial practice. It will decrease significantly the quantity of Load-shedding, particularly for the period of peak hours.

III. PROBLEM FORMULATION

The state of Karnataka topologically experiences four different seasons- summer (March to May), monsoon (June to September), post monsoon (October to December) and winter (January and February). Data was collected for daily load curves from October 2013 to September 2014 keeping in mind the seasonal trend. From the various load curve data collected, the average load curves for all days in a week was found out.

3.1. Analysis According To The Data Collected Through Load Curves For The Given Span

According to a load predict in 2009, the total use by household customers surrounded by the state of Karnataka is about 31 percent. In the midst of that the use in urban and metropolitan areas is about 36 percent while in rural areas the household use is 8-9 percent. The average total comes to be 31 percent for the entire state. Now, implementing that information within the data collected:

Month	Total Power Consumption(In MU)	Expected Domestic Consumption (31% of total) (In MU)
October 2013	4671.19	1448.07
November 2013	4874.03	1510.95
December 2013	5261.09	1630.94
January 2014	5617.58	1741.45
February 2014	5295.82	1641.70
March 2014	5767.40	1787.89
April 2014	5639.29	1748.18
May 2014	5066.66	1570.66
June 2014	4799.15	1487.74
July 2014	4791.35	1485.32
August 2014	4571.10	1417.04
September 2014	4497.07	1394.09
Total	60851.73	18864.03

3.2. End Use Of Electricity In Karnataka

There are mainly two dissimilar types of households within a specified region one is AEH (All Electrical Home) household and additional one in Non-AEH household. The different types appliances used within the state of Karnataka are categorized in the subsequently table for AEH households.

Table -1: AEH (All Electrical Home) household

Appliance Category	Wattage	Average appliance no per house holds	Usage hr per day	Usage hr per year	Consumption KWh per year		% of total consumption
					Per appliance	Per house holds	
Table lamp	40	0.1	2.54	927	37.08	3.71	0.15
Table fan	60	0.17	4.76	1737	104.24	17.72	0.69
Mixer	450	0.85	0.47	172	77.20	65.62	2.57
Refrigeration	100	0.6	22.33	8150	815.05	489.03	19.17
Air cooler	170	0.03	4.8	1752	297.84	8.94	0.35
Air conditioner	1500	0.01	0.81	296	443.48	4.43	0.17
Toaster	800	0.03	1.1	402	321.20	9.64	0.38
Hot plate	1000	0.28	1.37	500	500.05	140.01	5.49
Kettle	1500	0.03	1.1	402	602.25	18.07	0.71
Electric iron	750	0.67	0.48	175	131.40	88.04	3.45
StWH	3000	0.29	1.18	431	1292.10	374.71	14.69
IWH	1000	0.36	1.75	639	638.75	229.95	9.01
Vacuum cleaner	750	0.12	0.7	255	191.62	23.00	0.91
Television	100	0.81	3.93	1434	143.45	116.19	4.55
VCR	40	0.2	2.14	781	31.24	6.25	0.24
Radio	15	0.23	2.51	916	13.74	3.16	0.12
Mono recorder	20	0.24	1.82	664	13.29	3.19	0.12
Stereo recorder	50	0.31	1.74	635	31.76	9.84	0.39
Electric heater	1000	0.06	1.72	628	627.80	37.67	1.48
Battery charger	15	0.01	3.25	2286	17.79	0.18	0.01
Washing machine	325	0.21	0.71	259	84.22	17.69	0.69
Step- up transformer	400	0.04	0.89	325	129.94	5.20	0.20
Water pump	750	0.43	0.68	248	186.15	80.02	3.14
FL20	20	0.02	1.3	475	9.49	0.19	0.01
FL40	40	4.09	2.63	960	38.40	157.05	6.16
IL15	15	0.22	2.32	847	12.70	2.79	0.11
IL40	40	2.27	1.56	569	22.78	51.70	2.03
IL60	60	2.64	2.36	861	51.68	136.45	5.35
IL100	100	0.08	2.72	993	99.28	7.94	0.31
IL25	25	0.24	1.27	464	11.59	2.78	0.11
Fan	100	2.71	4.45	1624	162.43	440.17	17.25
Total						2551.34	100.00

The types of appliances used in non-AEH households:

Table -2: Non-AEH household

Appliance Category	Wattage	Average appliance no per house holds	Usage hr per day	Usage hr per year	Consumption KWh per year		% of total consumption
					Per appliance	Per house holds	
Table lamp	40	0.17	2.91	1062	42.49	7.22	1.04
Table fan	60	0.21	5.78	2110	126.58	26.58	3.84
Mixer	450	0.3	0.52	190	85.41	25.62	3.70
Refrigerator	100	0.02	24	8760	876.00	17.52	2.53
Hot plate	1000	0.01	1.7	621	620.50	6.21	0.90
Electric iron	750	0.31	0.51	186	139.61	43.28	6.25
IWH	1000	0.01	3.11	1135	1135.15	11.35	1.64
Television	100	0.47	3.67	1340	133.96	62.96	9.09
VCR	40	0.01	2.31	843	33.73	0.34	0.05
Radio	15	0.42	2.22	810	12.15	5.10	0.74
Mono recorder	20	0.24	2.25	821	16.43	3.94	0.57
Water pump	750	0.01	1.06	1500	1125.11	11.25	1.62
FL20	20	0.01	4.11	1190	23.80	0.24	0.03
FL40	40	1	3.26	2763	110.52	110.52	15.96
IL15	15	0.25	7.57	920	13.80	3.45	0.50
IL40	40	1.13	2.52	1205	48.18	54.44	7.86
IL60	60	2.12	3.3	1340	80.37	170.39	24.60
IL100	100	0.02	3.67	398	39.79	0.80	0.11
IL25	25	0.18	1.09	2413	60.32	10.86	1.57
Fan	100	0.5	6.61	2413	241.27	120.63	17.41
Total						692.71	100.00

3.3. Appliances That Can Be Used At A Lower Tariff Time-Of-Day

The end use study of electricity utilization in AEH houses has shown that the utilization of electricity is mostly due to lighting (27.98%), air circulation (23.42%), cooking (14.20%) and water heating (18.13%) and In non-AEH houses, the end uses secretarial for most of the utilization of electricity are lighting (39.43%), air circulation (20.76%) and entertainment 23.97%). The end use analysis of electricity in the residential sector for the whole of Karnataka has shown that the electricity is used mainly for lighting (32.28%), air circulation (22.31%), water heating (11.09%), entertainment (9.68%) and cooking (8.69%). So, for the whole of Karnataka lighting, air circulation, water heating, entertainment and cooking account for 84.05% of the total residential consumption. Thus the left over 15.95% is used for purposes in the vein of vacuum cleaning, ironing, washing machines, refrigeration etc. The

main variation that can be done to divide domestic customer is as AEH (All Electric Housing) and Non AEH.

Table - 3: The appliances that can be used at a different time of the day (AEH)

Appliance	Wattage	Average appliance no per house	Usage hr per day	Usage hr per year	Percentage of total
Electric iron	750	0.67	0.48	175	3.45
Geyser	3000	0.29	1.18	431	14.69
Vacuum cleaner	750	0.12	0.7	255	0.90
Washing machine	325	0.21	0.71	259	0.69
Water pump	750	0.43	0.68	248	3.14
Total					31.88%

Table - 4: The appliances that can be used at a different time of the day (non-AEH)

Appliance	Wattage	Average appliance no per house	Usage hr per day	Usage hr per year	Percentage of total
Electric iron	750	0.31	0.51	186	6.25
Water pump	750	0.01	1.06	1500	1.62
Total					7.87

Because the data was based on an assessment of 1200 households of which 825 were Non AEH and 375 were AEH households, consequently flouting it down percentile wise. Total percentage use by measured appliances in AEH houses= 31.88*(375/1200) = 9.963 %. So, total percentage utilization by measured appliances in non AEH houses= 7.87*(825/1200) = 5.411%. So the total percentage that is being consumed by individuals appliances within the entire state by both types of households = 9.963+5.411 = 15.374 %. As a result from the above table it is obvious to a big amount of electricity consumed by household customers can be utilized at a lot minor cost finally extremely plummeting the monthly electric bill for a buyer. Now, if this quantity of electricity is preferably used in lesser tariff slabs time era, then this quantity of power can be made obtainable for provide to commercial customers at much superior demand periods of the day. The whole power consumed by the household consumers in the state of Karnataka from October 2013 to September 2014 is 18864.03 MU. Then, 15.374% of that amounts to 2900.16 MU. This is the quantity of electrical energy that can be shifted from the high demand phases of a day so that improved situation of constancy can be maintained for commercial clients in an entire year. The purpose at this point would be to

present statistical directions to customers at household level as well as to the suppliers at the same time as to how much development can be brought about in the entire system by implementing this superior tariff plan.

IV. RESULTS AND STATISTICAL ANALYSIS

4.1. Cost Analysis

From the above tables we can see that: - Total use by an AEH house in a year = 2551.34 kWh, Total use by a non-AEH house in a year = 692.71 kWh. According to the most recent TOD propose there is a fall of 125 paisa per unit of consumption if it is used in the low tariff slab. So the decrease in bills for a household consumer in a year if he preferably uses the above mentioned appliances at a lesser tariff slab. For AEH houses = (31.88/100)*2551.34*125 paisa =101670.899 paisa = Rs. 1016.71. For non-AEH houses = (7.87/100)*692.71*125 paise = 6814.53 paise = Rs. 68.15

Avrage Load Curve Of Karnataka

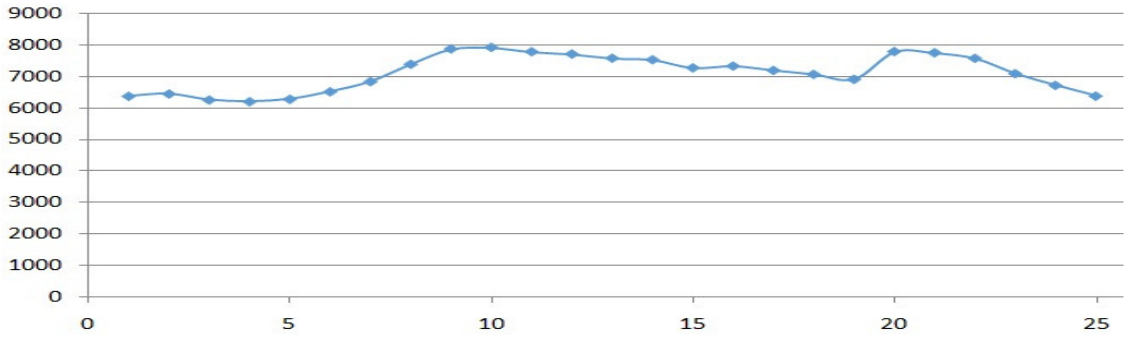

Fig - 1: - Average daily load curve of Karnataka

4.2. Load Analysis

The amount of load being use for an assured duration of time within a load curve be able to create by manipulative the area under the curve and the x-axis of the graph. The amount of power consumed on a standard within a day in Karnataka was set up out to be 171580.7 MWh which is the same to 171.581 MU. The total energy consumed on highest demand day (6^{th} March 2014) within the measured period was 204.11 MU compared to 173.739 on this very date a year previous. This shows how the state of Karnataka is progressively moving ahead towards urbanization as there is an enormous grows in the real utilization of energy within just a period of one year. Therefore the load factor for this era examine = Average Load/ Maximum Load= 171.581/204.110= .8406= 84.06%. Now, isolating the day into three different slabs of low tariff (22hrs to 6hrs), medium tariff (6hrs to 18hrs) and high tariff (18 hrs to 2 hrs) we get three different energy utilization totals as low tariff slab provides a total

of 51849.6 MWh which is equal to 51.8496 MU, the total energy consumption amounts to 89592.78 MWh which is equivalent to 89.593 MU in intermediate Tariff Slab and in High Tariff Slab the energy consumed for a four hour period (18 hrs to 22 hrs) is 30138.3 MWh which equals 30.138 MU. Now, if the standard every day utilization for the state of Karnataka is 171.581 MU then we can think about that on an standard 31% of that energy amounts for household purposes. That amount of household utilization would be 53.19 MU. From the above resultant quantity of energy, 15.374% pertains to the appliances that can be used at a lesser tariff portion of the day which is 8.177 MU. This also ascertains that the 8.177 MU energy would be exclusively used up in the low down tariff portion of the day therefore making that a large amount amount of energy accessible at other period of the day, thus serving to maintain a better balance within the entire system.

CONCLUSION

The work one in this paper gives a statistical directive like to how much money a household buyer on a standard can save if he opts for an up to date method of electricity pricing similar to time-of-day tariff. The statistics establish that a foremost amount of cut-back is probable for customers particularly for All Electric Households in a case where the customer perfectly takes sufficient responsibility to use assured appliances at a different and exact period of the day. Additionally, that substantial amount of electricity being used in low demand phases of the day shall help in improving constancy of the system as a whole.

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