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Research Article

Providing Cost Save by Using Electronic Meters in Residental Areas

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Abstract

In our country, the demand for electrical energy, which is a development indicator, is increasing day by day. Due to the limited energy resources to meet this growing demand for energy it is not only able to meet the increasing production. Therefore, the current system of electricity generation, transmission and distribution used more efficiently that is electrical energy saving has become very important today. For energy saving, advanced clock application and use of electronic meter such administrative precaution and the correction of power factor such technical precaution. The most important administrative precaution to reduce the use of energy at the most consumed period and hours is to apply a higher price rate at these hours. Thus, by shifting the cosumption at these hours to other suitable hours, a balanced energy consumption may be obtained. The measurement and billing of electric energy used within the day at different times are done by means of electronic meters. In this study, it explained how to achieve saving through the use of electronic meter and suggestions were made.

Keywords: Electronic meters, saving, peak period, tariff.

1. Introduction

Nowadays, in parallel to rapidly developing technology and industrialization, our energy requirement is increasing day by day. It is not possible to satisfy the requirement occured on energy by only increasing the generation in the same way. Because, generation of energy on the world and utilization of it is not sustainable. In other words, energy sources we have are finite(Celik & Teke 2015). Utilization of energy is increasing more and more today. In order to satisfy increased energy requirement of Turkey that is dependent on external sources about energy, saving precautions become more significant with efficiency principle to use energy more efficiently.

One of the mainly types of energy types is electrical energy that makes its presence felt in every aspects of our daily lives and become the essential element of economy and social life. Furthermore, it is a clean energy source which can be transmitted, utilized and controlled easily and also converted to another type of energy. These are the main factors that emphasize this energy.

Energy saving does not mean disusing energy or using it limited. Indeed, it means to use energy efficiently. Energy efficiency is to reduce the amount of energy consumption per unit of service or product without any decrease of the amount and quality of production in industrial enterprises and the standart of living and quality of service in buildings. While fulfilling requirements as heating, illumination and transportation or using electrical household appliances, shortly in every area of our lives, it is possible to contribute to protect the environment, economics of the country and family income by using energy efficiently without restricting requirements (EMO,2016). As energy saving precautions, it is taken administrative precautions like advanced clock implementation or using electronic meters and technical precautions like correcting power coefficient. However, in this study, it is explained how to provide saving by using electronic meter and recommended some advices about electronic meters.

2. Using Electronic Meters

One of the most effective precautions in using electrical energy efficiently is to encourage consumers to demand requirements of eletrical energy at off-peak hours. Two tariff options are available in electrical consumption for houses. First of these options is named as “Single – Rate Tariff” and the other is named as “Peak – Demand Tariff”. Consumers decide which one of these options is going to be applied. In single-rate tariff, electrical energy consumed all day by consumers is evaluated on a single price. On the other hand, in peak-demand tariff option, consumers pay on three different prices at three time periods: Day, Evening and Night. Instead of the total amount of consumption, calculations are done via consumptions occured in these periods. In this application, Electronic Meter users who choose his/her tariff as peak – demand tariff can benefit from this tariff.

According to “The Regulation About Amending in The Regulation on Internal Electrical Installations” published by “Ministry of Energy and Natural Resources” at 08.12.2000 dated and 24254 Issue numbered Turkish Official Gazette, application of electronic meters including peak – demand triff options has been obligated at installation in new buildings except very simple farm buildings, sheds and simple village houses since 08 December 2001. Electronic meters are completely user-oriented and are used to make the usage of electrical networks more efficient. These meters generally measure electrical energy hourly or in shorter intervals. This means they give real-time informations. Thus, they provide users to follow values as amount of consumption and power quality. Electronic meters have three types in usage; single phase meters, three phase meters and smart meters. Pictures of electronic meters are shown at Figure 1.

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(a)

(b)

(c)

Figure 1. (a) Single phase meter (b) Three phase meter (c) Combined meter

Single-phase meters seen at Figure.1(a), are meters that measure active energy consumption in single-phase systems. Three-phase meters seen at Figure.1(b), are meters that measure active energy consumption in three-phase systems. But, smart meters seen at Figure.1(c), are meters that measure both active and reactive energy consumption in three-phase systems.

Electrical consumption is concentrating between 17:00 and 22:00 everywhere(3e Electrotech). Therefore, when energy supplied from hydroelectric power plants does not satisfy requirements, thermal plants that have higher unit cost enter the system and, of course, this situation damages the economy of country. If electronic meters are used to measure electrical energy consumption, this consumption can be directed to non-intensive consumption hours and, in this way, both the economy of country and consumers can gain advantages from this situation.

Tax-free energy tariff prices and tariff segments applied by Turkey Electricity Distribution Company (TEDAŞ) to house groups since 01.01.2016 are given at Table 1. As shown at Table 1, it is clearly seen that the cheapest price in peak-demand tariff is at night period (21,1076 krş/kWh) and the highest price is at peak period (49,5950 krş/kWh). Therefore, by decreasing the amount of consumption at peak period, it will be a decrease at energy cost that will be paid.

Table 1. Tax-free energy tariff prices (TEDAŞ 2016)

Distribution System Users	Active Energy			
	Single Rate Tariff (kr/kWh)	Peak Tariff		
		T1 Daytime (06:00-17:00) (kr/kWh)	T2 Peak (17:00-22:00) (kr/kWh)	T3 Night (22:00-06:00) (kr/kWh)
Residence	33,1835	33,0449	49,5950	21,1076

The amount of energy consumtion of a family in a month can change according to the number of population in the family, cultural level of the family, working status of employees, economical status of the family, status of energy consumption habits and seasons. At the same time, according to a computation done by considering the power of electrical appliances and their usage times, it is stated that electrical consumption of an averagely 4-person family in a month is at a level of 230 kWh in accordance to minimum standard of living(EMO 2016). Electrical household appliances and their monthly average amount of energy consumption are given at Table 2.

Table 2. Household appliances and their monthly average amount of energy consumption(Kocaman 2012)

Household appliances	**Monthly average amount of energy consumption (kWh)**
Lighting	66
Refrigerator	70
Electrical Oven	24
Television	22,5
Washing machine	15
Dishwasher	13
Iron	10
Vacuum cleaner	5,5
Hair dryer	4,4
Total	230,4

As seen at Table 2, %28,65 of electrical energy is spent for lightening and %71,35 of electrical energy is spent for electrical household appliances except lightening. The data required for this study contains average energy consumption values of three months between December, 2015 and February, 2016. These values have been taken from 10 different consumers that are shown as A1, A2, A3, A4, A5, A6, A7, A8, A9, A10 and these consumers are peak-demand-tariff applied and reside at different zones in Tatvan, Bitlis Province. Because it is aimed to give general information to consumers, zones and consumers have been choosen arbitrarily. Energy prices that will be paid according to single-rate tariff and peak-demand tariff of average monthly energy consumption of consumers just mentioned are given at Table 3.

Table 3. Quantity and Cost of Energy Consumed

Consumer	Tariff	Energy Consumed (kWh)	Unit Cost (krş/kWh)	Single of Peak Tariff (TL)	Cost of Single Rate Tariff (TL)
A1	Daytime	40	33,0449	13,22	51,43
	Peak	45	49,595	22,32	
	Night	70	21,1076	14,78	
	Total	155		50,31	
	Single Rate	155	33,1835		
A2	Daytime	65	33,0449	21,48	63,05
	Peak	40	49,595	19,84	
	Night	85	21,1076	17,94	
	Total	190		59,26	
	Single Rate	190	33,1835		
A3	Daytime	95	33,0449	31,39	69,69
	Peak	55	49,595	27,28	
	Night	60	21,1076	12,66	
	Total	210		71,33	
	Single Rate	210	33,1835		
A4	Daytime	90	33,0449	29,74	74,66
	Peak	45	49,595	22,32	
	Night	90	21,1076	19,00	
	Total	225		71,06	
	Single Rate	225	33,1835		
A5	Daytime	65	33,0449	21,48	54,75
	Peak	30	49,595	14,88	
	Night	70	21,1076	14,78	
	Total	165		51,13	
	Single Rate	165	33,1835		
A6	Daytime	70	33,0449	23,13	76,32
	Peak	65	49,595	32,24	
	Night	95	21,1076	20,05	
	Total	230		75,42	
	Single Rate	230	33,1835		
A7	Daytime	90	33,0449	29,74	74,66
	Peak	50	49,595	24,80	
	Night	85	21,1076	17,94	
	Total	225		72,48	
	Single Rate	225	33,1835		
A8	Daytime	70	33,0449	23,13	71,34
	Peak	60	49,595	29,76	
	Night	85	21,1076	17,94	
	Total	215		70,83	
	Single Rate	215	33,1835		
A9	Daytime	50	33,0449	16,52	52,76
	Peak	34	49,595	16,86	
	Night	75	21,1076	15,83	
	Total	159		49,22	
	Single Rate	159	33,1835		
A10	Daytime	60	33,0449	19,83	56,41
	Peak	30	49,595	14,88	
	Night	80	21,1076	16,89	
	Total	170		51,59	
	Single Rate	170	33,1835		

If we analyse Table 3, it can be seen that only energy prices ay peak-demand tariff of consumer shown as A3 has been higher than energy prices at single-rate tariff. However, for the other 9 consumers, energy price at peak-demand tariff has been less than energy price at single-rate tariff. Total of energy prices of average monthly consumptions of consumers mentioned above becomes 622,63 TL if peak-demand tariff is used, else it

becomes 645,09 TL if single-rate tariff is used. From this, it is seen that about 645,09 TL- 622,63 TL = 22,46 TL saving is provided by using peak-demand tariff.

According to the data of Energy Market Regulatory Authority, as of January, the number of consumers is 35.764.298 for free consumers. %81 of them consists house-consumer group. The number of house-consumers becomes 35.764.298*0,81=28.969.081 according to this. It is clearly seen that if energy consumption of ten consumers using peak-tariff with electronic meters slip to low load-demand hours, it is provided energy saving of 22.46 TL monthly. When energy consumption of all consumers is considered by the same way, it is provided 28.969.081*2,246 TL= 65.064.555,926 TL for a month. Likewise, energy saving of a year is 65.064.556 TL *12 = 780.774.671,112 TL. This study has been done for a priorly province in development and has occured randomly chosen consumers if they have awareness about energy consumption or not. By changing consumption habits, in other words by disusing electrical machines which have high energy consumption such as dishwasher, oven, washing machine at peak times, it is apparent to provide saving. Also, by correcting daily load curve, efficiency of plants at system can be increased, energy transmission lines can be relieved and thus, it is gained advantages to government.

3. Results and Discussion

Due to the increase of consumption of electrical energy more and more, in order to install new energy plants to fulfill energy demand, it will be more economic to benefit from available plants more. Without any limitation in point of daily energy consumption, by using electrical machines which take extreme power at out of peak-time, it will be contributed to family income by paying less energy cost. Besides, transmission lines will have been protected against overloadings and faults that can be occured. In this study, by slipping energy consumption of ten consumers out of peak-time, it has been seen that 22.46 TL saving is provided according to use of single-rate tariff. By the same approach, annual saving for all house consumers becomes 650.645.56 TL *12 = 780774671,112 TL. Raising awareness of consumers about using peak tariff by electronic meters, organizing conferences to raise awareness of them and preparing educational brochures about it become more important for distribution companies. Thus, consumers will provide saving by paying less energy price, efficiency of the system of distribution companies will increase and government will benefit from this situation. Therefore, it is important with regard to saving that consumers using electronic meter should understand the importance of using peak-tariff and they should arrange their consumption habits according to this.

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