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Demand Response Program for Office Energy Management

Bunyawat Vichanpol[1], Jarun Khonrang[2]

[1]School of Energy and Environment, University of Phayao, Thailand
Email: wattojap@gmail.com
[2]Faculty of Industrial Technology, Chiang Rai Rajabhat University, Thailand
Email: jarun.kho@crru.ac.th

Abstract— *The study on Demand Response Program for Office Energy Management aims to design the demand response program being used with a solar energy generating set for office energy management .The experimental data are collected from the whole electrical power consumption in the office from 6 a.m. – 6 p.m. in order to seek for the guideline for the office energy management for the reduction at the demand peak through a demand response program and the guideline for the co-using with the alternative energy in reducing the peak demand. The electric appliances used in the office can be classified into two groups; unable stop and able stop at for some time. This study emphasizes on the later. From the experimental result, it discovered that the DR Program used with an electric generating set from solar cell can reduce the electricity consumption at 70.18 % of all energy used in the office meanwhile in 10 minutes the reduction capacity is 74.63 % and in 15 minutes the reduction rate of energy consumption is 80.28 %..*

Keywords— ***Demand Response Program, Office Energy Management, Energy Consumption, Demand Respond, Solar Cell.***

I. INTRODUCTION

Nowadays, the electrical energy is likely to be used higher and higher due to the expansion to the transportation and industrial sector, private and government sectors need the power energy in doing the activities in the office, particularly in the day time which is at the demand peak, resulting in providing more electrical energy to meet the needs of the consumers. Demand respond (DR) is another alternative in promoting and administrating the electrical energy consumption suitable which never affects the present activities, just adjusting how to use the energy. Moreover, it is another way to promote the use of alternative energy leading to reduction of the government burden in seeking for more other energy sources to keep pace with the new world relying mainly on electricity. With this energy management in the office, it is a way to use the electrical energy effectively and manage the electrical consumption suitable by a means of controlling the electrical appliances with the use of the solar photovoltaic generating set.

II. OBJECTIVE

To design the demand respond program used with the solar energy generating set in energy management.

III. RESEARCH METHOD

1. Data collection from the office is electrical energy consumption and the guideline on the electrical energy management in the office.

The data collection on the electrical energy consumption in the office is conducted to find out the guideline of the energy management in decreasing the amount of electricity at demand peak via the demand respond program and to investigate the guideline on the use of the alternative energy to reduce the demand peak as shown in fig. 1.

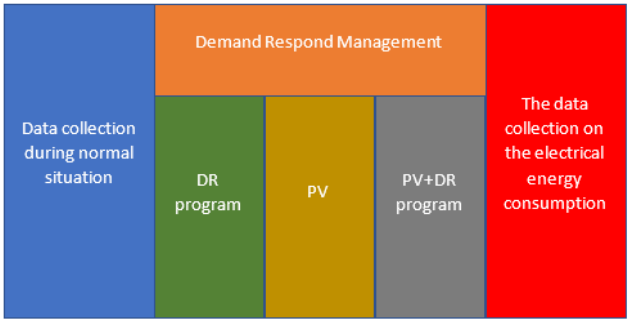

Fig.1: Model of the electrical energy management

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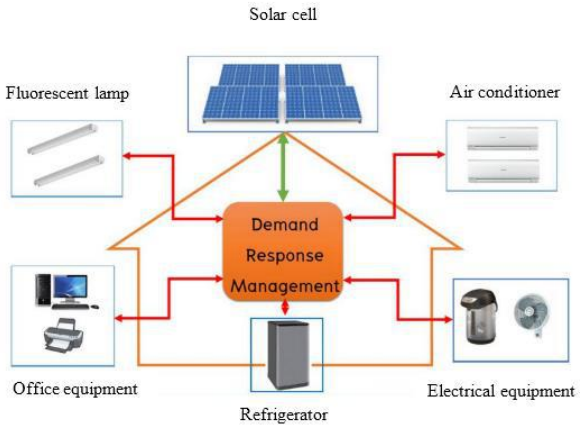

Fig.2: Electrical appliances for the electrical energy management

2. The classification of the electrical appliances in the office

The electrical appliances in the office can be classified into two groups.

2.1 Nonstop working group

Tab. 1: Type of the nonstop electrical appliance group

No.	List	Size (Watt)	Number (Item)	Total (Watt)
1	Refrigerator (10Q)	145	1	145
2	PC Computer	450	10	4,500
3	Printer	400	4	1,600
4	Fax	600	1	600
Total				6,845

2.2 Sometime stop working group

Tab. 2: Type of the sometime stop working electrical appliance group

No.	List	Size (Watt)	Number (Item)	Total (Watt)
1	Fluorescent lamp	42	18	756
2	Air conditioner	1,500	3	4,500
3	Electrical fan	75	6	450
Total				5,706

In controlling the operation of the electrical appliance for demand peak management by focusing on the sometime stop working and the load affecting the demand peak in the whole consumption in the office.

3. The rate of the electrical energy consumption in the office

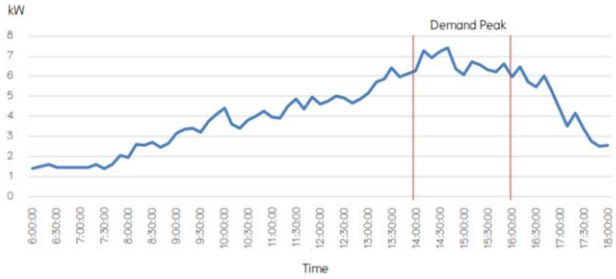

Fig.3: The average on electrical energy consumption

From fig. 3 it illustrated that the average rate of the electrical energy consumption of the office in thirteen days for the demand peak is between 02.14 p.m. – 04.24 p.m. During that the time, the electrical load affecting the demand peak is air conditioner.

4. The average value of the electrical energy consumption in the office

From data collection of the electrical energy consumption in the office is divided into two groups; nonstop working and sometime stop working, it discovers that time between 02.00 p.m. – 03.00 p.m. is the demand peak meanwhile 02.39 p.m. has the electrical energy consumption value 7.61 kW.

Fig. 4: The installation of Eco Power Meter to measure the amount of the electrical power used

IV. RESULT

1. The experiment on electrical energy consumption by using DR program. From the experiment in fig. 4, it reveals that the rate of the demand peak is between 02.00 p.m. – 04.00 p.m., so, to reduce the demand peak, the experiment is classified as follows;

1.1 Switching on the electrical appliance which can stop working for some time by focusing on the air conditioners consuming highest the electrical energy at the duration of 5, 10, 15 minutes and recording the value of the peak demand of the electricity consumption as show in tab. 3.

Tab. 3 : The duration of the current distribution to the air conditioners

No.	List	Size (Watt)	5 min			10 min			15 min		
1	Air	1,500	*	*	*	*	*	*	*	*	*

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	conditioner 1										
2	Air conditioner 2	1,500		*	*		*	*		*	*
3	Air conditioner 3	1,500			*			*			*

Form tab. 1, it illustrated that the control of using the air conditioners at the peak demand of the electricity energy consumption at the duration 15 minutes could reduce the electricity consumption at the peak demand 17.44 % of the whole electricity consumption.

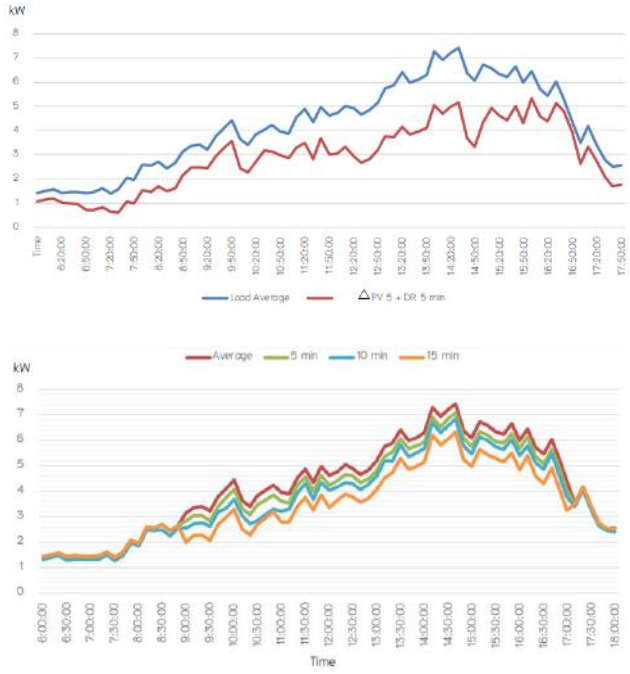

Fig. 5 : The comparison on electricity energy consumption by used DR program

From fig.5,The comparison on Demand Respond Program result, it found that to switch on the air conditioners in the duration of 5 minutes could reduce the power consumption when comparing with the application average at 5.55% meanwhile to switch on the air conditioners at the duration of 10 minutes could cutdown the electrical power consumption when comparing with the application average at 11.19% and followed by the duration of 15 minutes, the application average was 17.44 %.

2. The adoption of alternative energy together with the use to DR program

In order to reduce the peak demand on the electrical energy consumption, it could be done by using the alternative energy helping reduce the peak demand together with the measure of reducing during the high demand of the electrical consumption. From the experiment, it could reduce the electrical power by the use of 10 KWp solar photovoltaic cell via the use of DR program with 5 minutes together with the electrical energy from the solar energy generating set which could reduce the electricity consumption 70 % of whole electricity consumption in the office as shown in figure 6 and the use of DR program at 10 minutes together with the electrical power, obtaining from the solar energy generating set, could reduce the electricity consumption 74.63 % in the whole electricity consumption in the office as shown in figure 7 and the use of DR program at 15 minutes along with the electricity from the solar generating set could reduce the electricity consumption 80.28 % of the whole electricity consumption in the office as shown in figure 8.

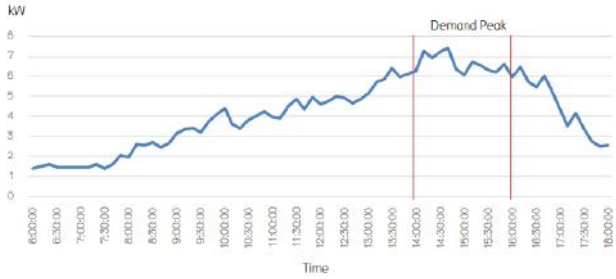

Fig. 6 The use of program in 5 minutes used with the electricity generating set from 5 kWp solar photovoltaic cell

From fig. 6 the comparison on the use of DR in 5 minutes used with the electricity generating set from 5 kWp solar photovoltaic cell can be able to reduce the amount of electrical energy consumption at 69.51% and at the time from 07.08 a.m. – 08.04 a.m. and 12.32 p.m. – 12.51 p.m.

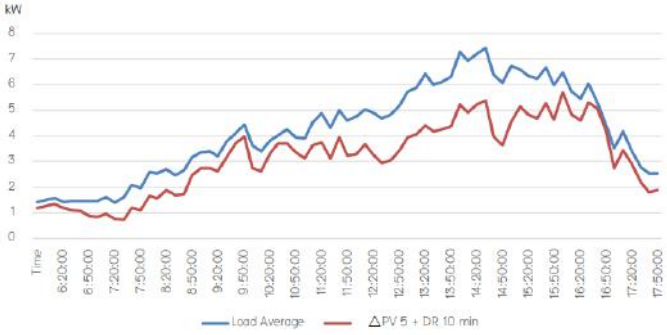

Fig. 7 : The use of DR program in 10 minutes use with the electricity generating set from 5 kWp solar photovoltaic cell

From fig. 7, it is the comparison the used of DR program in 10 minutes used with the electricity generating set from 5 kWp solar photovoltaic cell. Solar energy which is able to reduce the amount of the electricity consumption 75.15

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% and at the time between 07.02 a.m. – 08.04 a.m., 09.17 a.m. – 10.36 a.m. and 12.02 p.m. – 13.08 p.m.

Fig. 8 The use of DR program in 15 minutes used with electricity generating set from 5 kWp solar photovoltaic cell

From fig. 8, the comparison on the use of DR program in 15 minutes used with electricity generating set from 5 kWp solar photovoltaic cell from solar energy which is able to reduce the amount of the electricity consumption 80.28% and at the time between 07.07 a.m. – 08.04 a.m., 09.00 a.m. – 09.32 a.m., 10.08 a.m. – 10.42 a.m. and 11.52 a.m. – 01.36 p.m.

From the data mentioned above, it is clearly seen that the office can use the DR program in 15 minutes used with the electricity generating set in reduce the demand peak.

V. CONCLUSION

From the research result comparison on the electricity energy management in the office by selecting the demand peak at the time 02.14 p.m. – 03.59 p.m. by a means of controlling the electric device affecting the demand peak which the control will allow the device to work continuously instead of working together. The testing is done with nonstop working in 5,10,15 minutes respectively and the comparison of using DR program found that the open electric appliance in duration of 5 minutes can be able to reduce average electricity consumption as 5.55%, in duration of 10 minutes can be able to reduce electricity energy consumption as 11.19% and in duration of 15 minutes can be able to reduce electricity consumption as 17.44%. the amount of the electricity consumption as shown in figure 5 and the use electricity generating set from solar photovoltaic 10 kWp as renewable energy, it used with DR program which duration of 5, 10, 15 minutes can be able to reduce electricity consumption as 69.51, 75.15 and 80.28 % as shown in figure 8. Meanwhile the use of solar energy is taken to be used with the method of controlling the electric device at the time of the demand peak

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