PARTICIPATORY IMPLEMENTATION PLAN IN ELECTRICITY REDUCTION OF SUAN DUSIT RAJABHAT UNIVERSITY

NIPON TAKSIN

A THESIS SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR
THE DEGREE OF MASTER OF SCIENCE
(TECHNOLOGY OF ENVIRONMENTAL MANAGEMENT)
FACULTY OF GRADUATE STUDIES
MAHIDOL UNIVERSITY
2014

Copyright by Mahidol University

COPYRIGHT OF MAHIDOL UNIVERSITY

Thesis
entitled

PARTICIPATORY IMPLEMENTATION PLAN IN ELECTRICITY REDUCTION OF SUAN DUSIT RAJABHAT UNIVERSITY

Nipon Taksin
.....
Mr. Nipon Taksin
Candidate

.....
Asst. Prof. Sittipong Dilokwanich,
Ph.D. (Human Geography)
Major-advisor

.....
Asst. Prof. Saranya Sucharitakul,
Ph.D. (Demography)
Co-advisor

.....
Prof. Patcharee Lertrit,
M.D., Ph.D. (Biochemistry)
Dean
Faculty of Graduate Studies
Mahidol University

.....
Assoc. Prof. Parkorn Suwanich,
Ph.D. (Population Education)
Program Director
Master of Science Program in
Technology of Environmental Management
Faculty of Environment and Resource
Studies, Mahidol University

Copyright by Mahidol University

Thesis
entitled

PARTICIPATORY IMPLEMENTATION PLAN IN ELECTRICITY REDUCTION OF SUAN DUSIT RAJABHAT UNIVERSITY

was submitted to the Faculty of Graduate Studies, Mahidol University
for the degree of Master of Science
(Technology of Environmental Management)
on
November 25, 2014

Nipon Taksin
.....
Mr. Nipon Taksin
Candidate

.....
Assc. Prof. Sukhum Chaleysub,
D.M.(Communication media)
Chair

.....
Asst. Prof. Sittipong Dilokwanich,
Ph.D. (Human Geography)
Member

.....
Asst. Prof. Saranya Sucharitakul,
Ph.D.(Demography)
Member

.....
Prof. Patcharee Lertrit,
M.D., Ph.D. (Biochemistry)
Dean
Faculty of Graduate Studies
Mahidol University

.....
Assoc. Prof. Kampanad Bhaktikul,
Ph.D. (Civil and Environmental Engineering)
Dean
Faculty of Environment and Resource Studies, Mahidol University

Copyright by Mahidol University

ACKNOWLEDGEMENTS

This thesis is completed with special assistance from Asst. Prof. Dr. Sittipong Dilokwanich and Asst. Prof. Dr. Saranya Sucharitkul who provided their valuable time for research consultation and guidance. I would also like to convey all my thanks to Assoc. Prof. Dr. Sukhum Chaleysub, who gave useful suggestion.

Furthermore, I would like to thank Assoc. Prof. Dr. Sura Pattanakiat and the other faculty members at the Faculty of Environment and Resource Studies for instilling me with knoweldge and valuable experience to the researcher which results in this particular success. I must also thank all the staff at the Faculty of Environment and Resource Studies for accommodating and helping me in every aspect.

Moreover, I would like to convey my thanks to the people at Rajabhat Suan Dusit University and the Division of Buildings and Maintenance who have provided me with useful information including the director and the colleagues at Dusit Poll, Rajabhat Suan Dusit University along with classmates from batch 4 in the Technology of Environmental Management program at Mahidol University who have helped, guided and provided support along the progress of this thesis.

Lastly, I would like to highly thank my family, parents, aunt, brother and sister and Miss Supavadee Balee for having always provided me with wealth, support and education throughout entire life which allows me to overcome all the obstacles and for having motivated me to complete education. Thank you to all members of the Balee family for having always enquired, assisted and supported me throughtout.

Nipon Taksin

Copyright by Mahidol University

IMPLEMENTATION PLAN IN ELECTRICITY REDUCTION OF SUAN DUSIT RAJABHAT UNIVERSITY

NIPON TAKSIN 5236830 ENTM / M

M.Sc. (TECHNOLOGY OF ENVIRONMENTAL MANAGEMENT)

THESIS ADVISORY COMMITTEE: SITTIPONG DILOKWANICH, Ph.D. (HUMAN GEOGRAPHY), SARANYA SUCHARITAKUL,Ph.D.(DEMOGRAPHY)

ABSTRACT

The purpose of this research is to study the current electricity usage at Suan Dusit Rajabhat University. Moreover, this research aims to develop policies, objectives, measures and plans to reduce electricity usage. The development should be done through a participatory process. The qualitative research method that was implemented in this research was through a focus group discussion. The quantitative method was implemented in this research through the distribution of questionnaires. The sample size for the questionnaire (divided into 6 groups) were 991 samples. The results of the research can be shown as :

The electricity usage of Suan Dusit Rajabhat University is vary with an increase of student population.. However, the University administration has adopted a policy of energy conservation from the Ministry of energy. There are measures to reduce the use of electricity through out, which it makes the University's electricity usage decline.

In the survey of electricity saving behaviors of professors, staff and students, it revealed that all samples alert and cooperate in practice about saving electricity. There are only some students, who are not cooperative.

From the focus group discussion, it was determined that the Electricity Saving Management Group will maintain the original policy, which contains 6 items, without providing any alterations

The Electricity Saving Working Group has brainstormed ideas that would be 13 electricity reduction measures for the University's electricity saving policy. Every item will have a supporting implementation plan to make sure that the measures can be driven into real actions.

KEY WORDS: PARTICIPATION / ELECTRICITY REDUCTION / IMPLEMENTATION PLAN

117 pages

Copyright by Mahidol University

การวางแผนปฏิบัติการลดการใช้พลังงานไฟฟ้าแบบมีส่วนร่วม ของ มหาวิทยาลัยราชภัฏสวนดุสิต
IMPLEMENTATION PLAN IN ELECTRICITY REDUCTION OF SUAN DUSIT RAJABHAT UNIVERSITY

นิพนธ์ ทักษิณ 5236830 ENTM / M

วท.ม. (เทคโนโลยีการบริหารสิ่งแวดล้อม)

คณะกรรมการที่ปรึกษาวิทยานิพนธ์ : สิทธิพงษ์ ดิลกวณิช, Ph.D (HUMAN GEOGRAPHY) ศรัณยา สุจริตกุล, ปร.ด. (ประชากรศาสตร์)

บทคัดย่อ

การวิจัยครั้งนี้มีวัตถุประสงค์เพื่อศึกษาสถานการณ์ปัจจุบันของการใช้ไฟฟ้าของมหาวิทยาลัยราชภัฏสวนดุสิต และเพื่อกำหนดนโยบาย เป้าหมาย มาตรการ และร่วมกันวางแผนปฏิบัติการลดการใช้ไฟฟ้าของโดยผ่านกระบวนการมีส่วนร่วม โดยมีขั้นตอนทั้งการวิจัยเชิงคุณภาพ จากการสนทนากลุ่มและการวิจัยเชิงปริมาณ โดยใช้แบบสำรวจ และแบบสอบถาม โดยมีกลุ่มตัวอย่างเป็นผู้ที่มีส่วนเกี่ยวข้องกับการใช้พลังงานไฟฟ้าของมหาวิทยาลัยราชภัฏสวนดุสิต 6 กลุ่ม จำนวนรวม 991 คน ผลการวิจัยมีดังนี้

สถานการณ์การใช้พลังงานไฟฟ้าของมหาวิทยาลัยราชภัฏสวนดุสิต ผันแปรตามจำนวนนักศึกษาที่เพิ่มขึ้น ทำให้มีการใช้ไฟฟ้ามากขึ้นด้วย และเมื่อเกิดโครงการลดการใช้พลังงานในภาคราชการของรัฐบาล ผู้บริหารมหาวิทยาลัยจึงได้รับนโยบายอนุรักษ์พลังงานจากกระทรวงพลังงานมาใช้ โดยกำหนดมาตรการลดการใช้พลังงานต่างๆออกมา ทำให้การใช้ไฟฟ้าของมหาวิทยาลัยลดลง

จากผลการสำรวจพฤติกรรมการประหยัดพลังงานไฟฟ้าของอาจารย์ เจ้าหน้าที่ และนักศึกษา สามารถสื่อให้เห็นว่าทุกกลุ่มตัวอย่างตื่นตัวและให้ความร่วมมือในการปฏิบัติเกี่ยวกับการประหยัดพลังงานไฟฟ้า มีเพียงนักศึกษาบางส่วนเท่านั้นที่ยังไม่ค่อยตื่นตัวและให้ความร่วมมือ

ด้านนโยบายการลดการใช้พลังงานไฟฟ้า ปรากฏว่า คณะทำงานด้านการจัดการพลังงานของมหาวิทยาลัยราชภัฏสวนดุสิต ระดับผู้บริหาร มีมติให้คงนโยบายเดิม 6 ข้อไว้ ส่วนมาตรการและแผนปฏิบัติการลดการใช้พลังงานไฟฟ้า คณะทำงานด้านการจัดการพลังงานของมหาวิทยาลัยในระดับหน่วยงาน ได้ร่วมกันวางแผนปฏิบัติการในการขับเคลื่อนนโยบายทั้ง 6 ข้อได้ออกมาทั้งสิ้น 13 แผนงาน

117 หน้า

Copyright by Mahidol University

CONTENTS

		Page
ACKNOWLEDGEMENTS		**iii**
ABSTRACT (ENGLISH)		**iv**
ABSTRACT (THAI)		**v**
LIST OF TABLES		**viii**
LIST OF FIGURES		**x**
CHAPTER I	**INTRODUCTION**	**1**
	1.1 Importance of the study	1
	1.2. Objectives	5
	1.3 Scope of the study	5
	1.4 Research framework	7
	1.5 Glossary of terms	9
	1.6 Expected outcomes	10
CHAPTER II	**LITERATURE REVIEW**	**11**
	2.1 Condition of electricity usage problem in Suan Dusit Rajabhat University	11
	2.2 Ideas regarding electricity saving	14
	2.3 Ideas and theories relating to planning	21
	2.4 Theory on participation	28
	2.5 Related researches	32
CHAPTER III	**RESEARCH METHODS**	**37**
	3.1 Research procedure	37
	3.2 Population sampling	38
	3.3 Framework and research methods	41
	3.4 Data analysis	43

Copyright by Mahidol University

CONTENTS (cont.)

		Page
CHAPTER IV	**CURRENT SITUATION OF ELECTRICITY USAGE IN SUAN DUSIT RAJABHAT UNIVERSITY**	**44**
	4.1 Current electricity usage situation	44
	4.2 Electrical appliances	48
	4.3 Electricity saving behaviors of professors, staff and students	50
CHAPTER V	**ELECTRICITY REDUCTION POLICIES, MEASURES,AND IMPLEMENTATION PLANS OF SUAN DUSIT RAJABHAT UNIVERSITY**	**64**
	5.1 Electricity reduction policy	65
	5.2 Determination of electricity reduction measures	68
	5.3 Electricity reduction implementation plan	72
	5.4 Recommendations from the discussion group	88
CHAPTER VI	**CONCLUSION, DISCUSSION AND RECOMMENDATIONS**	**91**
	6.1 Electricity usage	91
	6.2 The change that affects electricity management	91
	6.3 Formulation of a participatory implementation plan on the reduction of electricity usage	92
	6.4 Result discussion	93
	6.5 Recommendations	95
BIBLIOGRAGHY		**97**
APPENDICES		**101**
BIOGRAPHY		**117**

Copyright by Mahidol University

LIST OF TABLES

Table		Page
1.1	National daily electricity needs (Megawatts) ,1987-2012	2
1.2	Electricity usage from Suan Dusit Rajabhat University , 2005 - 2013	4
3.1	Research framework	41
4.1	Amount and percentage of the sample group divided according to their roles	50
4.2	Awareness of electricity saving news	53
4.3	Values of average standard deviation following 16 behaviors in electricity saving of professors, staff and student	56
5.1	The separation of electricity meter of each building	71
5.2	The study on the investment on the installation of solar panels on the roofs and the rooftops	74
5.3	The brainstorm of ideas for time allotment to prevent peak hours (9:00 a.m. – 10:00 p.m.)	75
5.4	The improvement on the air-conditioning system	76
5.5	The improvement on the light illumination	78
5.6	The improvement on the efficiency of office automations	79
5.7	To increase the efficiency of communication on the reduction of electricity usage	80
5.8	To hold a meeting to create a framework to reduce the electricity usage and to determine the goal of each division	82
5.9	The “Watchful Eye project”	83

Copyright by Mahidol University

LIST OF TABLES (cont.)

Table		Page
5.10	To provide training on the reduction of electricity usage at the office	84
5.11	To provide training on the reduction of electricity usage in the classroom and the laboratory	85
5.12	To survey the opinions of people on the matter related to the reduction of electricity usage in the university	86
5.13	To hold a meeting to brainstorm ideas to determine or improve the policies, objectives and plans related to the reduction of electricity usage	87

Copyright by Mahidol University

LIST OF FIGURES

Figure		Page
1.1	Suan Dusit Rajabhat University map	6
1.2	Research framework	8
2.1	Six types of participation in management	30
4.1	Suan Dusit Rajabhat University current electricity usage during 2005-2013	46

Copyright by Mahidol University

CHAPTER I
INTRODUCTION

1.1 Importance of the study

Thailand is a developing country. Governments have attempted to manage the prosperity of our economics by focusing to develop the following sectors: industry, tourism and agriculture. The source that fuels the development process depends on the amount of electricity that the government uses. To be specific, we are talking about raw electricity such as oil, gas and coal that can be converted into electricity. Electricity is a driving force that will help the government to accomplish their development plans. From the journal of The Electricity Policy and Planning Committee (2002), it was reported that in the first quarter of 2002 Thailand commercial electricity needs reciprocate with the economic development plan of the country. To look at it closely, the percentage of electricity consumption increased 5.9 percent as compared to the same period of time in the year 2001. There was an increased in demand for almost every type of electricity; thus, it was necessary for us to import electricity. It can be seen that electricity is an imperative factor that drives Thailand's economic growth.

Moreover, an increase in demand of electricity is a result of population growth as well as their salary raise that has caused them to purchase items that help to enhance their lives. Some more reasons that contribute to a rise in electricity needs include: change in family structure where in the past big family stays under one roof but nowadays each family members tend to stay alone in their private accommodation. The growth of industrial sector is also another reason and lastly is a large size of government sector that has to cater to more personnel. For these reasons, there had been high electricity consumption as shown in Table 1.1

Copyright by Mahidol University

Table 1.1 : National daily electricity needs (Megawatts) ,1987-2012

Year	National daily electricity needs (Megawatts)
1987	4,733.90
1992	8,876.90
1997	14,506.30
2002	16,681.10
2007	22,586.10
2012	26,121.10

*Statistics regarding the highest electricity consumption from year 1989-2012 gathered from Electricity Generating Authority of Thailand (www.egat.co.th/index.php?option=com_egatstatistics&view=hellos&Itemid=881)

There is a high tendency that electricity usage will increase as years go by; thus, the government has constantly launched the electricity saving campaign throughout the years.

Moreover, in 2005 the government body has passed the resolution to define a strategic solution to tackle nation's electricity problem. The solution was to ask every government sector and state enterprise to decrease their electricity usage by 10 percent as compared to the year 2004. This has been set as a KPI for every sector. The Office of Public Sector Development Commission (OPDC) has set the KPI starting from the fiscal year in 2006. The commission has assigned the permanent secretary from each ministry to be in charge of achieving the KPI. Any government sector that is able to reduce their electricity usage wins a monetary prize. Recently on 19 February 2013, the government released a new set of electricity policy asking every government sector to reduce their electricity usage by 10 percent as compared to the previous year. If it happens that a sector could not accomplish this goal and uses 15 percent more electricity, that sector may be punished by receiving less funding for the next fiscal year. This is a way to encourage government workers to be aware of their electricity usage and they would try their best to keep their usage as low as possible.

Copyright by Mahidol University

Suan Dusit Rajabhat University is considered to be a government sector under the Education Ministry. The university has started its operation on 17 May 1934. They started out as a school teaching general subjects and they have gradually

improved until they become a university that we know of today. In 2004, the university has expanded with higher number of students and staff. Due to this, the university found it necessary to build more facilities such as buildings, study rooms, office equipment, vehicles etc. Because of this, the need to use gas and electricity has proportionally increased.

Thanks to the government's electricity saving program, Suan Dusit Rajabhat University can use this opportunity to encourage its staff and students to take part in the program. Some of the benefits that the university will gain includes:

1. The University can save its electricity cost.
2. The University fiscal year's fund will not get a cutback.
3. The University helps the nation to reduce electricity usage.

Suan Dusit Rajabhat University has taken some actions to promote the electricity saving campaign by going around university venues and help to publicize the campaigns through various activities such as giving out pamphlets, organizing talks and wearing T-shirts with the electricity saving program logo. These activities have been ongoing since 2013. It was found that the campaign did not produce such good results. A change in students and staff behaviors could not be tracked once the campaign was no longer active. For example, lights remained to be on once the last person left the room, air-conditioned is turned on at a lower than standard temperature, doors remained open despite the air-conditioned being turned on, students and staff bring in their personal electronic appliances to charge in the sockets around university's facilities. As part of the university's policy of providing laptops to all the freshmen, so the students would feel the need to charge their laptops at all time. Because of all the above behaviors combined, the university's electrical expenses have continued to increase on a yearly basis. The below table shows the amount of electricity used in the University.

Copyright by Mahidol University

Table 1.2: Electricity usage from Suan Dusit Rajabhat University, 2005 - 2013

Electricity Usage		
Fiscal year	**Electricity unit (kWh)**	**Electricity unit increase or decrease (kWh)**
2005	13,821,782.00	-
2006	13,173,998.00	decrease 647,784.00
2007	14,371,021.00	increase 549,239.00
2008	13,473,084.00	decrease 348,698.00
2009	14,274,890.00	increase 453,108.00
2010	14,340,973.00	increase 519,191.00
2011	13,538,937.00	decrease 282,845.00
2012	13,485,119.00	decrease 53,818.00
2013	13,268,219.00	decrease 216,900.00

Remarks: The number from year 2005 was used as a standardized base to determine if the amount from each year was increased or decreased

Source: Suan Dusit Rajabhat University Electricity Saving Program, (2013)

From the observation and questionnaires given to university staff and students it was found that the reason that the electricity saving campaign did not succeed is because there was a discontinuation in the publicity of the campaign. Moreover, there was an insufficient channel for the publicity so the campaign could not reach out to majority of the people in university. There was an insufficient amount of equipment that are utilized for the campaign such as billboards, stickers and printed T-shirts; and most importantly the implementation plan for this campaign was unclear. The campaign conducted by the University lacks a clear direction and a comprehensive implementation plan. The evaluation is not systematic and there was no motivation to get people to change their behaviors

In order for an electricity saving program for the University to be successful, the following should have been stated in its implementation plan: objective, policy, procedure and goal. Activities conducted should have also been diverse and staff should have been closely monitoring the campaign to see if it steered out of the original plan or not. If an institution wanted to plan for an electricity saving program, it requires a collaboration of people who are

Copyright by Mahidol University

directly involve in the electricity usage. This can be carried out as a research so that an institution can gather information from every context such as information from sample group, information from participants, information from opinions of people agree and disagree with the campaign. This is so that everyone can utilize the information to plan and monitor the results.

The such situation has inspired the researcher to conduct a research on electricity saving planning in form of participation so that the researcher can present the information to the University and they can later implement this across the institution. Hopefully, this can help them to effectively reduce the usage of electricity and be in line with the government's electricity saving plan for the nation.

1.2. Objectives

1. To study the current electricity usage situation in Suan Dusit Rajabhat University

2. To determine policy, goal and procedure in form of participation among Suan Dusit Rajabhat University staff in order to effectively reduce electricity usage

1.3 Scope of the study

This researcher determined the scope of study as follows:

1.3.1 Sample group, which can be divided into 6 minor groups as follows:

1. Electricity saving management group of Suan Dusit Rajabhat University consisted of 22 people

2. Electricity saving working group from the institute level of Suan Dusit Rajabhat University consisted of 20 people

3. Student council of Suan Dusit Rajabhat University consisted of 11 people

4. Professors of Suan Dusit Rajabhat University consisted of 270 people

5. Academic support staff of Suan Dusit Rajabhat University consisted of 301 people

Copyright by Mahidol University

6. Students of Suan Dusit Rajabhat University consisted of 367 people

1.3.2 Study area

The study will be conducted within the venue of Suan Dusit Rajabhat University-property number 295, Ratchasrima Rd, Dusit District, Bangkok, 10300.

There are 13 buildings that that are used for educational purposes and office purposes as can be seen below:

1. Dean office Building	2. Liberal arts Building
3. Building 1	4. Building 2
5. Building 3	6. Building 4 special education
7. Dusit poll Building	8. Building 11
9. Building 13	10. Lecturers Building
11. Sarapee Koo Building	12. All classes Building
13. Princess Sirindhorn Building	

Copyright by Mahidol University

Figure 1.1 Suan Dusit Rajabhat University Map

Source: Suan Dusit Rajabhat University Building Division, (2013**)**

1.3.3. Scope of the time

The study about electricity usage of Suan Dusit Rajabhat University is between 2008-2013

1.3.4 Target

Suan Dusit Rajabhat University has worked according to the university's electricity saving plan created in the fiscal year 2013, and is expected to reduce electricity usage to the followings:

Short-term: Reduce the cost of university's electricity by 5 percent in 2-3 years

Long-term: Reduce the cost of university's electricity by 10 percent in 5 years

1.4 Research framework

The planning of electricity saving usage in form of participation of the University is a study of a relationship between man and the environment. All those who are involved in the electricity usage of the university should be aware of the university's usage on electricity and the behaviors of people who use electricity. This is so that every sector can discuss about the issue in order to improve the policy and goal of the previous plan and come up with an efficient implementation plan. Also, it is important to conduct an interview to collect opinions of people who are associated to this project regarding the possibility of making implementation plans. By doing this, we can predict if the plan can work or not. Lastly, if there is a flaw with the plan, anyone is welcome to provide their suggestions and comments so that the plan can be modified accordingly.

Copyright by Mahidol University

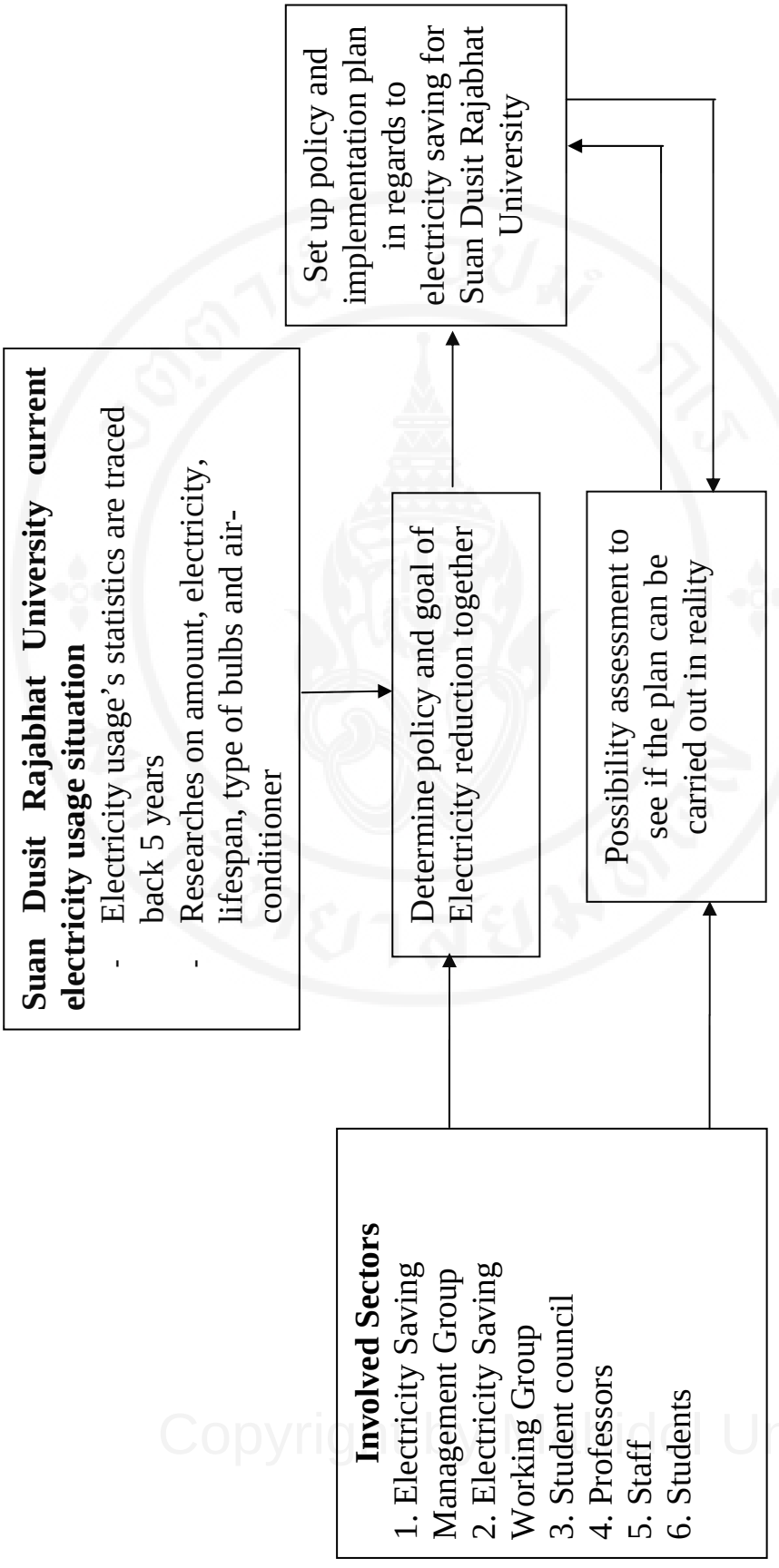

Figure 1.2 Research Framework

Copyright © Dusit Thani College

1.5 Glossary of terms

The researcher has stated the definition for specific terms as follows:

Implementation planning: Determine the details of electricity saving operation according to the policy and goal of electricity saving implementation plan from Suan Dusit Rajabhat University

Electricity reduction: Reduce the use of electricity in Suan Dusit Rajabhat University (only the one in Dusit District campus, Bangkok) as targeted

Electricity saving management group: A group of people consisted of university's management level to plan a framework and control the working process of electricity saving project

Electricity saving working group: A group of people comprises of representative from different departments to coordinate in managing the electricity saving project

Student council: Students representatives that are elected by the students to make decision for the university's student body

Professors: Professors from Suan Dusit Rajabhat University only from the following faculties: Faculty of Humanity and Social Science, Faculty of Management, Faculty of Science of Education and School of Tourism and Management.

Academic support staff: Staff from university's different departments by taking into consideration only the head from each department.

Students: They are currently studying in the following faculties**:** Faculty of Humanities and Social Sciences, Faculty of Management Science, Faculty of Education and School of Tourism and Hospitality and they take classes from the University only

Copyright by Mahidol University

1.6 Expected outcomes

1. Solid policy, goal and action for the University's electricity saving implementation plan

2. Good behavior for University's personnel to be considerate when using electricity

3. Electricity cost reduction by 10 percent within 5 years

4. Electricity saving awareness and a sense of collective participation for the University's personnel to use electricity with care in order to have a balance between man and environment

Copyright by Mahidol University

CHAPTER II
LITERATURE REVIEW

The researcher reviewed relevant literatures to use as a guideline for an electricity reduction plan among Suan Dusit Rajabhat University personnel. The researcher studied documents, ideas, principles, theories and related researches as follows:

2.1 Condition of electricity usage problem in Suan Dusit Rajabhat University

2.2 Ideas regarding electricity saving

2.3 Ideas and theories relating to planning

2.4 Ideas and theories relating to participation

2.5 Related researches

2.1 Condition of electricity usage problem in Suan Dusit Rajabhat University

Suan Dusit Rajabhat University is a well-known institution in Thailand. It has produced remarkable works that contribute to our society in the area of children, food industry, nursing industry, servicing sector etc.

The most updated total number of students is 20,631. With an increase in the number of students, demands for professors have also risen in relations to that. Due to this reason, the university experienced a high expense situation. Thus, the university has searched for ways to save cost. For example, utilize the facilities to its maximum potential by arranging students from many majors to be studying under one building. Only students from the following faculty: Faculty of Science and Education, Faculty of Humanity, Faculty of Nursing, School of Culinary Arts and Faculty of Science have the privilege of studying in their individual faculty buildings. This has helped the university to reduce cost in the areas of constructions, procurement, equipment

Copyright by Mahidol University

purchase and building maintenance to a certain extent. As for the budget for electricity usage, Suan Dusit Rajabhat University could not meet the number provided by the government. The government states that the university must be able to reduce its electricity usage by 10 percent from the previous year. However, the electricity cost for Suan Dusit Rajabhat University up to date has been increasingly high

2.1.1 Electricity saving policy

According to order number 4002/2012, Suan Dusit Rajabhat University appointed a team to work especially on electricity reduction project. The team has drafted policy, goal and procedure regarding electricity reduction as follows:

1. Develop the management system appropriately so that it coincides with the laws and other rules

2. Improve electricity usage efficiency for each organization continually so that it suits with the working environment

3. Plan a yearly electricity saving objective and distribute the plan so that the personnel understand and can follow the plan accordingly

4. Electricity saving is the responsibility of staff from every level and every staff should take part by following the policy that has been created. Also, the staff would need to monitor and report to the group in charge of electricity saving project

5. Support human resource department by injecting them with sufficient budget and giving them time to train staff in other department so that everyone can learn to participate and provide comments that would help to improve electricity related projects

6. The executives and those who are directly working on the electricity saving project should revise and amend the policy and objective on a yearly basis

Copyright by Mahidol University

2.1.2 Electricity saving measures

Suan Dusit Rajabhat University came up with a slogan that says “Suan Dusit unite as one to help save the electricity”. The intention of having this slogan was to serve as a message to raise awareness for the electricity saving campaign. On top of that, the university created some protocols for personnel to follow as can be seen below

1. Turn air-conditioner on and off only at this specific hours: from 08.30-12.00 and from 13.00-16.00
2. Air-conditioner should remain off during non-office hours, with the exception of some sectors that have to come to work on holidays
3. Turn on air-conditioner15 minutes prior the meeting and turn air-conditioner off right after the meeting is over
4. Turn air-conditioner off every time no one is working in a room or the person has left the room for a long period of time
5. Air-conditioner temperature should be adjusted to 26 degrees Celsius
6. In case you have to travel from one floor to the next, use the stairs rather than an elevator
7. Turn off the lights every time you leave the office, the canteen, the meeting room and the bathroom
8. Turn off all electrical appliances when not using it and remember to unplug it as well
9. Turn off the computer screen when not using it for more than 15 minutes and unplug it immediately when finishes using it.

All of these protocols were made in accordance to the electricity saving slogan: “Turn off the lights. Adjust the AC. Unplug when not in used”

In order to reach electricity reduction goal as set by the government, the University should consider the policy, objective, goal and policy in order to create an action plan that can recruit people to participate in an electricity saving project. This is so that the university can efficiently reduce electricity for a sustainable period of time

Copyright by Mahidol University

2.2 Ideas regarding electricity saving

2.2.1 Principle of electricity saving

Electricity is considered to be a prime factor that is essential to our survival. As we all know, we have limited amount of electricity sources. However, because of population growth a higher demand of electricity is an inevitable case scenario. In every level of electricity consumption, there is always an adverse effect that will be produced on the environment. Humans must learn how to use electricity efficiently and economically so that we will have sufficient electricity for the future. We must halt all the projects that require for us to find secondary electricity source before every electricity source is depleted. It is undeniable that electricity usage has become a nationwide problem

Knowing how to appreciate the value of electricity; hence, use it efficiently is an important thing. We must search for ways where we can control the use of electricity effectively. One of the ways that we can do is to educate people to be careful not to waste electricity in every activity they do in life. We should learn to stop using unnecessary portion of. What we can also do further is to establish an electricity consumption plan and decide on a clear electricity saving measures. Broadcast news on the correct way to use electricity as well as things to do when using electricity. For example, electrical appliances selection process by choosing the ones with the most efficient power saving mode such as bulbs, air-conditioner and electricity-saving refrigerators. These choices should be there for consumers and consumers must make decision based on their electricity saving conscience. Consumers should know that electricity saving electrical appliances will also help them to save cost. Another method is to integrate nature to help save electricity for example, planting trees, keep the balance of nature, conserving the ecosystem, forests and wild animals. When designing for houses, the doors and windows should be wide enough so that the house can receive sufficient sunlight. This is another method to rely least on electricity.

Materials such as paper, metal and plastic should be recycled and avoid using products that are environmentally harmful to express the responsibility of the electricity depletion and natural degradation problem. If everyone can follow the suggestions strictly and continuously, the result would show in the balance of nature

Copyright by Mahidol University

(Jirapol Sinthunava, 1994). Jaruay Boonyubon (1976) has stated two solutions to the electricity problem. These are the solutions that can be carried out in present days and they are saving the electricity by reducing the use of unnecessary electricity for example, reduce heat leakage, prevent heat from escaping by using the right type of insulation, change the way of living to reduce the use of electricity by using public transportation and using less of personal vehicles. Television airtime should be reduced. Neon lights used on billboards should be turned off and use only relevant amount of lights. Improve the efficiency of equipment, system and production process by adjusting some of the industrial process so that it requires less electricity. Electricity should come with appropriate design such as creating an efficient motor. Improve the efficiency of electricity system by adjusting the power effects. Another interesting way is to search for a new type of electricity to replace fossils. This will be something that will occur in the future.

Jullada Chaihuadcharoen (1993) has mentioned that electricity preservation can be derived from the following factors:

- Increase the efficiency of the producers. This means that using the same amount of fuel to produce more electricity or producing the same amount of electricity and using the same amount of fuel.

- Increase the efficiency for the distributor meaning preventing electricity loss during the delivery of electricity. In simple words, this means prevention damages to the delivery line.

- Improve the efficiency of users meaning using limited amount of electricity and make the most out of it or make the most from the same amount of an input electricity but uses it less for example, uses bulbs with high efficiency that will help to reduce the use of electricity by 10 percent but still gives out the same level of brightness.

Therefore, conserving electricity from end users means improving electricity usage but still saving it at the same time.

Summary of electricity saving that has been written so far:

1. Reduce the use of electricity in cases such as using only necessary electrical appliances, turning air-conditioner off at buildings. We should work together to save electricity by reducing activity that requires large electricity consumption

Copyright by Mahidol University

2. Improve electricity usage efficiency by using electricalappliances with higher efficiency such as fixing the electricity system by adjusting the power effects. Plant trees and help to preserve the ecosystem, forests and wild animals.

Electricity saving refers to making the most of the electricity by taking into considerations the level of brightness, eye level, the convenience in setting up and the fixing of electrical gears. Matsuo Motoki (2000) has talked about it as follows:

The principle of electricity saving is choosing the right type of bulbs such as bulbs that has high brightness. This is very crucial in relations to electricity saving as it helps to reduce the number of bulbs that will be used or help to reduce the size of bulbs. If the fluorescent attached is type T-12 (diameter of 38 millimeters), and has been changed to fluorescent type T-8 (diameter of 26 millimeters), both bulbs produce the same level of brightness but one uses 10 percent less electricity. If the fluorescent attached is the day light type and has been changed to the white light type, this would help to increase brightness by 10 percent if the shining spot is at a specific area and use a lamp that is reflective. This would help to brighten up the lower part to around 70-80 percent. Before using incandescent bulb that helps to light up a specific spot, when changes to CFL bulb it would give equal amount of brightness but uses only 20 percent of electric power as compared to an incandescent bulb. This helps to save 80 percent of electricity and the lifespan of a CFL bulb is 10-12 times longer. If currently you are using high-mercury vapor bulb and has changed to a high efficiency metal halide lam, which fits to a ballast resistor of any mercury bulbs, it gives out the same level of brightness and uses up only 30 percent of electric power as compared to a high-mercury vapor bulb. As for a high pressure sodium bulb, which fits in to a ballast resistor of any mercury bulbs, gives out the same level of brightness but uses only 28 percent electric power as compared to a high-mercury vapor bulb. In order to save electricity, it is essential to shop for the right type of equipment that would help to reduce the use of electricity. Some points to keep in mind includes: shop for highly efficient equipment that can give out optimal brightness result. The equipment should also be reflectance coefficient and transmittance coefficient. The equipment can be easily cleaned and the bulb can be easily changed. For the bulbs that are used to light up specific areas, lights normally get into the eyes; hence, it might be necessary to include a reflective lamp, a sieve or a cover. Choose equipment that uses less electric

Copyright by Mahidol University

power. Choose equipment that make the most of the heat emits from the bulb as this would help to reduce the electricity that will be converted into heat inside a room. Building structure should be taken into consideration when shopping for electricity saving equipment. The electric line and the switches must be installed in convenient places. Turn off all the lights during lunch time to cut off electricity from the entire frame board. Another way is to turn off some of the lights such as in certain room or where the machines are located.

When installing electric line so that it can help save electricity, the following points must be kept in mind:

- The area must be able to receive natural lights and does not require lights from electric bulbs at all time. The on-off switches must be installed in a convenient location and simple to use
- When installing the circuit for the bulbs, it is best to install according to product line so that when someone is working overtime, they can only turn on the lights in their section and switch off lights in other sections
- The following are some things to take into considerations when switching off selective bulbs. Switching off lights by taking out the bulbs (fluorescent bulb) would cause more damage. This is because rust would form on each end of the bulb and there will be a loss of electricity when the ballast resistor is not intact. The right way to do this is to install the switch on the primary side of the equipment and close the entire set. In case where there is an inconsistent brightness emerging from different areas, a specific area brightness equipment should be installed to adjust the brightness to be in the same level.

An internal environment arrangement is also one of the ways that would help to save electricity. For example the colors for the wall, ceiling and floor must help to enhance the brightness of electricity. A room with both bright and dark partition helps to save electric power to about 20 percent. If it is a big room that contains both big partition and small partition that would help to save about 30 percent of electricity. Cleaning the wall and re-painting the room would help to illuminate better while a dirty room with dirty wall, ceiling and floor would dim the brightness of a room. Another electricity saving principle is to control the work flow of electrical equipment maintenance. This should be done regularly. Lights installed outside the

Copyright by Mahidol University

building must be able to switch automatically on and off or it can be set on timer. It should not be the type that required the switch to be manually press before lights go off. Bulbs should be cleaned constantly at the right period of time to maintain the illumination condition. Use a measuring device to track if the bulbs are too old or have dust accumulate inside. Record the data and use the information to manage the environment that is too brightly lit. For example, the same type of bulbs with the same features, when using it in a highly dusty area and less dusty area for 20 months under the same condition, result shows that there is a difference in the outcome of brightness for almost 30 percent. Therefore, in an area where dust is likely to form it is advisable to constantly clean the bulbs. The last principle is to make the most of natural light. In the afternoon, make use of sunlight in rooms where natural light can reach. The switches should be installed especially for lights that are next to the windows in order to save that part of the electricity. Natural lights coming through the windows should be measured so that an extra bulb can be installed to give out sufficient lights for the jobs.

The knowledge gained from electricity saving can be divided into :

1. A highly efficient supplementary equipment should be installed and this requires for an expert to help select for the right type of equipment

2. Electricity saving starts from the users behaviors. The users must have the mindset to save the electricity and their actions would reflect the electricity saving patterns. Users should take care of electric equipment such as the bulb by constantly cleaning it. The place where users place the equipment must be filled with minimal dust. This is because dust is the main factor that reduces electric equipment lifespan resulting in an insufficient level of brightness coming from the bulbs

2.2.2 Ways to save electricity

What needs to be done is for every group involves is to study the total number of bulbs. Unnecessary bulbs should be removed as well as old bulbs should be replaced with electricity saving bulbs. Bulbs installed in places must help to enhance the working environment. If a neon bulb is used, a reflector lamp must also be included and an electric saving ballast resistor should be inserted in this case. For walkways, terrace or bathrooms, low watts bulbs should be installed. Always turn off

Copyright by Mahidol University

the lights when not in used. Always clean both sides of the bulbs, the bulb body and the lamp. This is to allow electricity to flow freely so that no electricity loss is incurred and lights can illuminate thoroughly.

2.2.3 108 ways to save electricity (Energy Conservation Promotion Fund, 1998) summarized according to electrical appliance used:

Electricity saving tips from using electrical appliances

- A way to save electricity when using electrical appliances and bulbs is simply to switch it off. Make this as a habit before leaving the room.

- A working lamp or a lamp should be installed in specific areas instead of turning on lights to fill the entire room.

- In order to allow lights to cover the entire area an electricity saving bulb must be paired with an electric saving ballast resistor or pair an electrical ballast resistor with a skinny bulb. When choosing for electrical appliances, make sure they have the standard electricity saving logo.

- Clean the bulbs at least 4 times per year to increase the level of brightness.

Electricity saving tips from using air-conditioner

- Turn off air-conditioner when leaving the room for 30 minutes-1 hour.

- Adjust the air-conditioner temperature to be between 25-26 degrees Celsius. A 1 degree Celsius increase in temperature means more electricity usage for 5-10 percent.

- Always check for holes in a room that has air-conditioner installed.

- Do not keep too many items in a room with air-conditioner as those items might absorb electricity produce by the air-conditioned.

- Install heat insulator to reduce excess heat from flowing into the buildings so that the air-conditioner do not function to an extreme point.

Copyright by Mahidol University

- Avoid transferring heat from outside the air-conditioner room into the room and always clean the air-conditioner filters as it helps to save electricity cost.

Electricity saving tips on a timely basis.

- Turn on air-conditioner when start working and turn it off immediately after the end of office hours.

- Turn off every electrical appliance during 12.00 – 13.00 and you will notice a huge cost reduction in the electricity bill.

- For those who are using electrical stove, it is best to turn off the stove 5 minutes before the food is fully cooked. Once the stove is off, heat will remain on a stove for a good 5 minutes

Electricity saving tips from daily routines.

- Check the durability of the refrigerator's rubber to make sure that the cool does not escape out of the fridge. Make sure to close the fridge properly every time using it. Clean the inside of the fridge as well as the heat extractor at the back of the fridge.

- Do not damp the clothes too much when ironing your shirts as it would require more electricity. Always unplug before ironing your last piece of cloth because the reaming heat will be released. Do not unplug the iron so often as a high amount of electricity is required to heat up the iron each time you turn it on. Avoid wearing suits as it takes an incredible effort and electricity to iron it.

- Always fill in the washing machine and keep in mind that washing 1 piece of cloth is equivalent to washing 20 pieces of clothes as the amount of water use for the entire process is the same. It is better to dry the clothes rather than using the drying machine as the machine eats up large amount of electricity.

- Switch off the T.V. when no one is watching. Do not increase the brightness of the screen and keep the volume down as these 2 factors contribute to your electricity bills. If you stay under one roof, let's buy one T.V. and share.

- Always dry your hair before using the hair dryer.

- It is better to use gas for cooking rather than electric stove.

- Unplug the electric kettle once the water is boiled.

Copyright by Mahidol University

- Install a system that reduces electricity flow into the computers when not in used as that would help to save 38-40 percent of electricity. Switching on the computer's screen immediately when turning it on helps to save 60 percent electricity.

- When taking one flight up or down, it is better to use a stairs and try to avoid using an elevator. This is because every time an elevator operates, 7 BHT of electricity is being spent (Energy Conservation Promotion Fund, 1998)

Electricity saving from installing electrical system.

- Separate the switches so that you can choose which light bulbs to turn on or off instead of turning on one switch and the entire house lights up.

- Avoid installing electric equipment near areas that emit heat.

- Always maintain the electric equipment to be in its functional state.

- Use low watts bulb for an area that requires to be lit up all night

Electricity saving from adjusting exterior atmosphere.

- Plant trees around the buildings especially big trees. One big tree produces the same cooling effect as a 1 ton air-conditioner or the cooling effect is equal to 12,000 BTU. Plant tress to get rid of sunlight that penetrates through the roof this is so that the air-conditioner does not have to work too hard.

- Plant small trees to add the moistness to the soil and this would help to produce the cooling effect to the buildings.

- Paint the buildings using light colors as well as paint the wall outside the buildings so that it helps to reflect lights.

- Make the most use of natural lightings.

2.3 Ideas and Theories relating to Planning

Planning is a crucial process for every organization. Planning helps the organization to achieve their desirable goals. A plan needs to be managed appropriately and efficiently by making the most out of limited resources.

Copyright by Mahidol University

2.3.1 Definition of planning

Planning refers to outlining a framework of things to do, and this includes the methods, time and the people who will be responsible in the process. Planning must be done beforehand in order for the people in charge to learn about the origins, objective and methods that would help them to achieve the objective. This is so that they can work effectively as well as make a constructive forecast. (Piyathida Treedet, 1998) Planning also correlates to the decision making process that will take place in the future. The important steps include what to do, where to do, how to do and when to do. All of these steps will directly affect the working result (Green, 1999). Planning helps to prepare people who will be engaged in the operation as it links to the future and people in charge can come up with some form of solutions of unexpected obstacles that may arise during the working process. Planning allows managers to control the work flow to be in accordance with what they have created Planning can be summarized into 4 pointers as follows:

1. It is a process
2. It is an alternative to action
3. It is a set of instructions that help to bring action to objective
4. It is a forecast to the future

Planning is an attempt to select decision making methods for future actions. The framework, methods, time and people in charge have all been pre-determined. The focus of planning would be to come up with the best methods that would help to achieve the objective.

2.3.2 The importance of planning

Planning is important and it is essential to every organization because it specifies what an organization needs and how to make those needs achievable in the future. Academic reasons, relevant information and offer for solutions help to eliminate potential obstacles that might arise along the way. Planning gives purpose to the operation, and everyone can work in a systematic, orderly and timely manner (Arkhom Jansuntorn, 1986). A plan will help the managers to see if the operation has been a success or a failure (Allen, 1982). A plan helps working more time efficient. A

Copyright by Mahidol University

plan helps to define problems and provide various solutions to solve it. A good planning reflects a clear goal and policy (Ouaychai Janpanyasil 1985). Planning before working means that managers must lay out a new plan in order to make the most out of it. Those who will be working according to the plan must make sure they have a good understanding of the objective and policy since these are the most important aspects of a plan. Any factors that would come in handy for the planning process must be prepared. Those factors include: information, related news, people, finance, materials, venue etc. A working process must be pre-determined by the plan so that a policy to counteract any damage can be created (Boonman Waricha, 2006).

2.3.3 Problems found during in planning

Many scholars have talked about some of the problems in planning. The first one is the use of outdated information. The macro-level or national-level of information is readily available, but information regarding planner's own organization is limited (Sippanond Ketthut, 1985). Also, when planning for a regional level local needs are neglected. Or the localize planning sometimes does not correlates to the regional planning. All of these problems is due to insufficient access to relevant information, the planner do not have a good grasp of the procedures, the objective written in the project is unclear. All of these have caused the operation to go haywire; thus, it is difficult to evaluate the effectiveness of the plan. Moreover, there is an ever-changing shift within the organization so the plan requires a constant, unexpected change. Sometimes, the plan is inflexible in its nature so to change it would be out of the question. Eventually, that plan would be outdated. There are also times where planning process has been carried out but the plan was never put into effect because there was not enough fund to run the plan. Planners and managers from every level receive inadequate education for planning (Sananjit Sukondthasub, 1981). There is a lack of innovative leaders, who have the patience, enthusiastic about planning and is willing to sacrifice his/her time for planning. The organization never prioritized so when it comes the time where their budget is cut they do not know how to go from there; therefore, have to start all over again. A plan does not receive support from the community or those who will be affected by the plan. The planning process is inconsistent and not systematic as well as lacks the independency (Chanchai

Copyright by Mahidol University

Arjinsamaja, 1984). There is no reporting standard that can be used to talk about planning (Prachum Rodprasert, 1985)

2.3.4 Types of planning

The type of planning depends on each organization. The organization should carefully look at the type of planning that will be most beneficial to their organization. Some widely-used types of planning in Thailand are as follows:

2.3.4.1 Planning based on time

Normally, this type of planning is governed by a specific period of time that a plan should be implemented. Data from the past is used in the analysis process. The decision making process is made in the present. Evaluation is done in the future (Hicks, 1972). In this type of planning, time is the prime factor that highlights the difference of planning. The plan that depends on the time includes: short term plan, medium term plan and long term plan. Short term plan has an operating timeframe from 1 year but not over 2 years, for example an annual plan. Medium term plan has an operating timeframe of 3-5 years. Long term plan has an operating timeframe of more than 5 years. For example, family planning, clean water planning (Prachum Rodprasert, 1996; Thonglor Detthai,).

2.3.4.2 Planning based on the characteristic of the criteria which can be divided into 3 types as follows:

- Emergency planning is created to tackle emergency problems. This type of plan is usually short term as it is created to tackle the problem that arises at that specific period of time.
- Normal planning is an annual planning created to define actions need to be taken in that year. The timeframe for this is definitely 1 year starting from the beginning of a fiscal year.
- Development plan is created with the aim of improving, changing and enhancing the project. This is usually a long term plan with a timeframe of more than 5 years.

Copyright by Mahidol University

2.3.4.3 Planning according to the condition of an organization

Cleland & King stated that there are 4 types of planning that falls under this category as follows (Cleland & King cited in Anant Katewong, 1998)

a) Mission plan or the model plan: This is the highest type of planning for an organization. It states a broad objective of the company as well as the organization's policy as it serves as a guidance for the subordinates. Private organizations are fond of creating their mission plan as a strategic plan that helps to define the direction and objective of operation

b) Corporate development plan: This plan lists out important processes and the direction that will drive the organization to success. The plan must also specify the needs of the environment so they can create a plan that reflects the condition in the future.

c) Implementation plan: This is where the organization takes the blueprint from the mission plan to create an implementation plan. Implementation plan will be more detailed. It will list out the names of people in charge, time period of operation. This is for the benefit of monitoring and controlling the working process to be according to plan

d) Project plan: This is a very specific plan. This is a basic plan yet it also serves as a success indicator for an organization

2.3.4.4 Planning according to the substance of the plan or according to the different level in the organization

This plan allows the organization to have an overview direction of whether the plan is created in the national level, bureau level or operation level (Public Health Bureau of Policy and Strategy, 2000) The plan can be categorized as follows:

- Policy planning: The policy is aimed for the national body that was appointed by the government. Policy helps politicians to run the country. A policy is merely a broad direction that helps to make sure that the working process coincides with the objective of the organization.

- Strategic planning: Each department will have to create a strategy that would help to govern their working process. For the strategic planning, planners can specify the resources that will help them to have a clear direction of when they actually get to work on a project

Copyright by Mahidol University

- Implementation planning: As the name stated, this is a planning done for the operational stage

2.3.5 Elements of implementation plan

Implementation plan is used as part of a working tool for every organization. Various elements are included into implementation plan so that we can see the condition of a problem, the need to develop, operational direction and how to measure success. The elements for an implementation plan are as follows:

- Project name: This should be short and concise. It should be consisted of what the project is about, who are what will be effected by the project (Somwang Pitiyanuwat, 1997)
- Principle and reason: This talk about origins of the project. This part highlights the fundamental idea of the plan. It helps to explain the reason and the necessity to work on the project. In simple words, it defines the core value of the project (Nirat Eimami, 1997)
- Objective: This is the most important part of the plan because it defines the direction of the working process. Once the project comes to a close, an objective will be used to evaluate the accomplishment of the project. What needs to be clearly states in the objective are the plan, what is this project about, results, and objective in the form of numbers (Nirat Eimami, 1997)
- Scope of the study: Scope that needs to be defined are such as the timeframe that will need to spend on this project, methodology and this should be written in a step-by-step format according to the policy, activity and the time period that has been discussed. More topics to be written down are what to do, how to do it. It would be best if you can quantify everything. If there is a third-party or another organization involved, you must also include the third-party's name in. This can be divided into 3 phases preparation phase, operation phase and evaluation phase. For the operation phase, operation tactics must be stated and a chart to manage every step must be included. For the evaluation phase, the project will be summarized and assessed.

Resources needed are another factor that managers must pay attention to. Resources must be used appropriately and they must be utilized for the purpose of achieving the goals (Pickett & Hanlon, 1990). There are 3 types of resources, which are man, money and materials.

Copyright by Mahidol University

An evaluation is a continuous process and results can be tracked from time to time. Evaluation allows us to see the final condition of the project and whether it was completed on time. By conducting a set of evaluation when the project is operating, it will allow us to spot a mistake that we can fix it in a timely manner. So, the damage would not be that detrimental. Evaluation can also assist with the decision making. Evaluation should correlates to the goal and objective that have previously been written. A tool and success indicator should be defined as well as a clear method of evaluation together with an evaluation timeline

When writing up the structure of the plan, stakeholders must be taken into consideration and it must be stated of what kind of benefits the stakeholders can expect to gain once the project comes to a close (Nirat Eimami, 1997)

For this study, the researcher has created an implementation plan that will help to define electricity reduction in Suan Dusit Rajabhat University. This implementation plan is a program-based and not a project-based. The element of the implementation plan consists of the followings:

Program Name “Electricity saving implementation plan”

Organization involves: “Suan Dusit Rajabhat University”

Reasons, objective, goals, methodology and process comprise activity, objective (minor), timeframe (of each activity), people who are involved and electricity reduction policy for Suan Dusit Rajabhat University, evaluation (define success indicator) and expected outcomes.

2.3.6 Steps for implementation planning

It comprises 5 parts, which are preparation for planning which involves the definition of operational structure relating to positions, data preparation. This step will entail the meeting with committee, data survey and analysis (Jureephan Hamkhampai, 2001) problem analysis, and ranking problems in accordance to its importance. Next step includes plan formulation which starts from drafting the plan which could be long term plan, mid-term plan or short-term plan depending on the goal of the plan by defining mission, goal, operation, execution including measurement procedures and plan evaluation (Regional Health Division, 1999, 14). When planning is completed, we arrive at the stage of plan implementation for execution, which could be said that

Copyright by Mahidol University

this implementation plan will divide up the work into portions; scheduling time frame for operation identifying work system, individual positioning, work supervision and work regulation (Somkid Bangmo, 1998). Next step involves monitoring, control and evaluation, which might include plan for internal inspection in the form of inspection report according to operational time which could be investigated for evidence of work reasonably which reflects responsibility to duty and the work of performer (Bureau of policy and public health plan, 2000). Last stage entails plan revision or re-planning. Plan execution is a continuous process, which would result in effective management; therefore consistent plan revision is necessary. If problem arises from execution, the environment relating to the plan has been found to be changed there must be an adjustment to the plan accordingly to comply with the environment at the moment or there might have to be re-planning altogether depending on the case. (Uthai Boonprasert, 1989)

To sum up, there are 5 steps for planning operations as stated above which are preparation for planning, plan formulation, plan implementation for execution, monitoring, control and evaluation as well as plan revision; adjustment or re-planning.

2.4 Theory on participation

2.4.1 The definition of participation

There has been a person who defined participation as cooperation; part taking in something including responsibility (Kannika Chomdee, 1981), which is related mentally and emotionally to the group situation. The result that follows would stimulate contribution to accomplish the goal of the group. Also, it would encourage the feeling of group responsibility by taking the form of the following equation “participation= cooperation+ coordination+ responsibility” (Nirand Jongwutthiwate, 1984) by allowing public participation or taking part in the execution of any step or all the steps depending on the permissibility of the circumstance. But to allow for true success of execution the people should participate in every stage of execution and the boundary for public participation can be classified as follows (Thakulthorn Thanapongsathorn cited in Thongchai Santiwong, 1996) problem detection and source

Copyright by Mahidol University

of the problem, implementation planning to help familiarize in effective decision making. Investment and execution help the people to learn about execution of activity by themselves so they would know the benefits that they will obtain and the process of monitoring and evaluation to allow the people to know whether the activity is receiving feedback or good benefits or not Unicef (UNICEF, 1982 cited in Midgley, 1986) and the United Nations (United Nation, 1978) have defined public participation as part of the process for development as the people must have faith, freedom in themselves, be enthusiastic and must possess the power to participate in decision making process to define the goal that the society desires and take care of resource management. To accomplish that goal the people must participate in plan implementation or other projects voluntarily and must take part in monitoring that the plan can still survive even if the third party that has involved themselves in the project have already quit.

To summarize the definition of participation can be termed as the cooperation of a group of individuals to do something by coordination together in any process or all the processes with group members participating willingly, coordination and taking responsibilities to the project plan until the goal is accomplished ensuring that the project still exists.

2.4.2 Types of participation

Participation has numerous categories of execution. Kannika Chomdee (1981) has concluded that there are 10 types of participation. There are participation in meetings, participation in investment, participation in leadership, participation in doing interviews, participation in being inducers, participation in being consumers, participation in being project originator, participation in being laborer and participation in contributing equipment. According to Nirand Jongwutthiwate (1984) participation can be categorized into 2 types, which are direct participation through representative organization and indirect participation. Pairat Techarin (1984) has defined participation to be having 8 features integrative learning, research on problems, the cause of problem in the community, inventing and establishing the way to solve community problem or to create new things that would benefit the community or to answer to the needs of the community, lay down policies, plan or activities to

Copyright by Mahidol University

eliminate or solve the problem and meet the demand of the community, participate in the decision making process to decide on the use of limited resources to yield the fullest benefits to the entire public, to hold or improve management system; develop quality, participate in the investment of activities, community projects according to the capabilities of self and the institution. Participate in policy implementation, plans, projects and activities to reach the set goal. And the last type is to participate in the monitoring and evaluation and to help take part in maintaining the project and activities that have been carried out. Meanwhile, Uphoff (1977) states that there are 4 types of participation, which are participation in decision making which could be the decision from the beginning of the activity. The participation in carrying out the activity, the participation in obtaining benefits and the last one being the participation in public evaluation.

Keith (1981) has categorized the types of management into 6 categories as seen in the figure 2.1

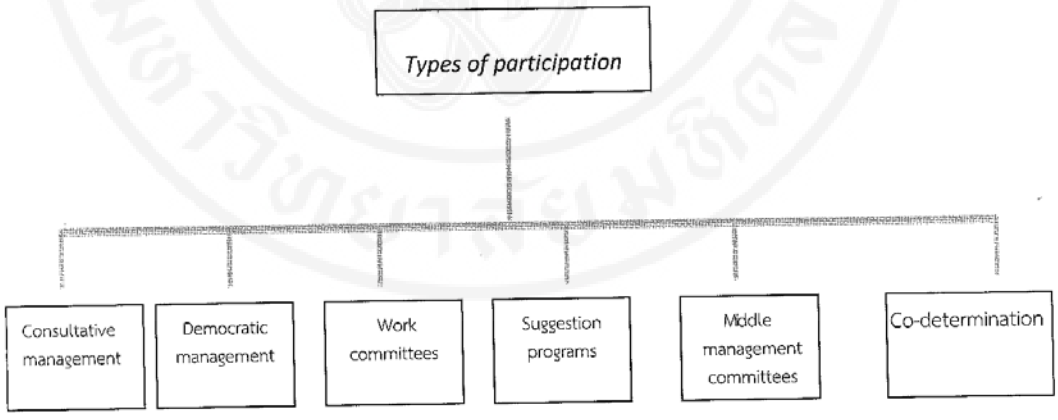

Figure 2.1. Six types of participation in management
Source: Davis Keith (1981)

The types of participation that has been stated above concluded two issues, which are the type of direct participation and indirect participation. In some type there is a use of systematic planning, which involves the participants to determine their

Copyright by Mahidol University

needs, policy, goal, the establishment of the plan format, development project, policy and project plan implementation, the monitoring of evaluation process including the type of participation that utilizes the method of consultation that depends majorly on the opinions of the leaders and also employs democratic system to encourage the group to participate in decision making process, improvement, planning, implementation an evaluation.

For this study, the researcher has used mixed methods to allow for the suitability and to comply with the context of Suan Dusit Rajabhat University which is to make use of the opinions of the target population by permitting every member of the group to contribute in expressing opinions, examining stipulation of policy, goal, regulations and the preparation for the electric electricity implementation plan. The decision will arrive from the group resolution. Every group member has freedom to express opinion and provide suggestions in the agenda that is being discussed.

2.4.3 Steps of participation

Jermsak Pinthong (1983) has stated that the public participation comprises of 5 stages, which are problem identification stage, problem examination and putting problems in order of importance stage, identifying the cause of the problem stage, examining the solution stage, plan implementation for solution stage and the development plan evaluation stage. Similarly, Totsapon Krityapisit (1994) has related that participation for development can be categorized into 5 stages, which are the initial development stage; the people take part in identifying the problem including its cause in the community. They further determine prioritize the demands of the community. In the planning for development stage; the people take part in determining the policy and the mission of the project; defining the procedures, implementation, resource allocation and the source of resources usage. The development stage allows the people to involve themselves in generating benefits by sponsoring monetary resources, equipment and labor or taking part in management, corporation and coordination for assistance externally. The stage of obtaining benefits from development; the people are involved in receiving benefits that they deserve from development in terms of objects and mind. In the stage of development evaluation; the people take part in evaluating whether the success is accomplished according to the set

Copyright by Mahidol University

goal. It could be a formative evaluation, which evaluates the progress in phases or summative evaluation, which evaluates the overall result. Additionally, Thirawut Senakham (1998) has proposed the principle to increase the strength of the community in the systemic participation of the people that follows. The definition of problematic issue by giving opportunities for the people to think of the problem from the benefit aspect; benefits for self and benefits for others, which would stimulate the people to take part in problem solving of the community. In the stage of creating options for the community through the process of close examination, which is a decision making process that connects closely with implementation even though an agreement has not yet been reached. However it is providing a broad way to emphasize the goal that is in relations to the participants to allow for consciousness to proceed with the activity, which is a way to build group collective power to carry out the activity that has been decided on. In the stage of public activity execution; is an activity that calls for collective power of the people; it has varieties and requires a big number of people. This arises from the considerate conservation, which is used to determine the general ways to proceed with the activity. Public activity is created from collective goal of the people, which builds up the collection of power to generate strength for each other. Public evaluation of activity stage is the allowance of people decide whether the efforts put in and the activity being carried out is beneficial or not and whether it is valuable to the community. This is a way to let the people to evaluate and adjust the activity continuously.

To conclude, the stages of participation is a group of individuals, collective power of the people or community residents that are able to take part in the process of something; in the initial process of development to create alternatives for the community, the planning for development stage, implementation stage, benefit obtainment stage and lastly the evaluation stage.

2.5 Related researches

Copyright by Mahidol University

Butrbamroong Thammachote (1998) studied the electricity saving in commercial buildings: The case study of Phaholyothin Building, Kasikornthai Bank. The study revealed that there are 12 ways for electricity conservation, which are 1.to

use high quality electric motor, 2.to install brightness regulator, 3. to use ballast with low level of drainage, 4.to move the electric transformer into one place, 5. to use the system of maintenance that protects the type of air conditioners that has separated air cooler 6.to install high quality air conditioners, 7.to install high quality water cooler, 8. to install electrical thermostat 9.to install thermal insulation on the walls to allow cool airflow at every floor, 10. to use reflective electric lamp, 11.to use fluorescent lamps that can conserve electricity, 12.to relocate the electric transformer into one single place.

From the assessment of break-even point and investment including the impact that will occur, only 6 ways can truly conserve electricity, which are 1, 2, 6, 7, 8 and 9 We can finally conclude that the methods above can effectively reduce the electricity consumption approximately 6.5 percent

Sasivimon Palasri (1994) has studied the behavior in news receiving, knowledge, perception and behavior in electricity consumption economically of the staff who work in government agency, state enterprises and the private enterprises in Bangkok. The study reflected that:

1. The sample group that work in different occupations, which are civil servant, state enterprise officers and private company employees possess varied economical electricity consumption.

2. Most of the sample group comprehends the news from the press moderately. They receive the news from the press campaigns in a low level. They possess the knowledge and the economical consumption of electricity in a high level. They have positive perception towards economical consumption of electricity.

3. The behavior in receiving news relating to the press campaigning has positive relationship to the behavior in economical consumption of electricity.

4. The knowledge in the economical consumption of electricity does not have any relationship to the perception of the economical consumption of electricity.

Copyright by Mahidol University

5. The knowledge of economical consumption of electricity does not have any relations to the perception of the economical consumption of electricity.

6. The perception of economical consumption of electricity does have positive relation to the behavior in economical consumption of electricity.

Kanchana Sornkeawdara (1999) has studied the behavior of electricity saving of 329 personnel at Mahidol University, The study that founded that mostly personnel have behavioral energy saving electrical work in the high 39.8 percent, 33.1 percent had moderate and 27.1 percent lower power consumption and saving behavior depends on the level of education and access to information at the level of statistical significance at the 0.05 level.

Pongsan Suwannachot (1994) worked on a dissertation under the topic of the design of an office space for economical electricity consumption in Bangkok. The office space and aviation simulation center building at Thai airways revealed that the value of heat ventilation from the walls and roof of the building is lower than determined when the project is designed in accordance to the guidelines for economical electricity consumption in buildings at the initial stage. When designing the frame of the building and selecting suitable material for the frame of the building are completed, it is found that the following index is lowered. This points out that the designed project according to the hypothesis above can effectively helps in the economization of electricity consumption. The design of building for economical electricity consumption acts as a guideline for architects and related parties to help in the economization of electricity consumption. Besides, it can also preserve the environment very well.

Waraporn Laohachakul (2001) has worked on a qualitative dissertation with the purpose to study the methods to establish implementation plan and the characteristics of the components of the implementation plan including the obstacles in planning and the implementation of the plan by the regional Public Health officers at Rayong province with the total sample population of 76 people. The data were collected through questionnaire on implementation planning and the evaluation on the characteristics of the plan created by the researchers. The research revealed that the sample population has a method of creating implementation plan with the rate of plan implementation being as high as 75 percent. The plan drawing is about 76.3 percent. The ranking of the importance of problem is approximately 75 percent. Data evaluation is 65.8percent Data collection and data examination is about 53.9 percent.

Copyright by Mahidol University

In terms of the components of the plan in accordance to the implementation plan and the format of the overall project implementation is around 43.4percent. The hindrance in creating implementation planning are the budget, data collection and data evaluation, which can be calculated as 51.3 percent, 38.2 percent and 36.8 percent in order. In terms of plan implementation, the most obstructive problem is the inadequacy of resources, which is about 36.9 percent.

Therdphan Saowapakmetheekul (2012) is conducted research on the development of the implementation Plan supplements were created with the participation of local communities. The process SRM District Chakkarat Chakkarat District, Nakhon Ratchasima. The objective is to develop an action plan said. A total of 124 samples were collected from the survey context. Group Chat The action plan developed health of the public. The research has indicated the context of the parish community Chakkarat. Such as demographic data Cultural characteristics of the community Health Care System Health Information When such information is then put into the development process. This process consists of seven stages of the development process which will create an action plan with the participation of the supplements were 12 community health projects covering all four sides, and found that participants engage in process activities at every stage. By sharing, commenting on the health and wellbeing of people in the district. Learning and leadership development of an action plan supplements were created by community centers.

From close examination on related researches, it is found that the economical consumption of electricity can be carried out in many ways by using the guideline in designing new buildings to have the structure and equipment that facilitate the economical consumption of electricity. Another method is to use the equipment and installment of equipment with high quality, which will help in the economical consumption of electricity. Most of our individuals have knowledge on electricity saving at a high level. We are ready to corporate in electricity saving if the institution or state organization need the coordination in establishing, determining policy, goal and identifying measure for economical consumption of electricity that is suitable to the context of the corporation; to assign as annual implementation plan to ensure clarity in the operational guideline that is consistent throughout the entire corporation and can effectively solve the economical consumption of electricity. In addition, it can

Copyright by Mahidol University

also study energy policies of universities and organizations abroad. And comparative advantages, to create a policy to reduce electricity consumption at the Suan Dusit Rajabhat University.

Copyright by Mahidol University

CHAPTER III
RESEARCH METHODS

This research studies the participatory planning on the operation on electrical electricity reduction for Suan Dusit Rajabhat University. This study employs mixed methods that have the following procedures

3.1Research procedure

3.2Population sampling

3.3Framework and research methods

3.4Data analysis

3.1 Research procedure

Researcher designed this study by utilizing mixed methods to plan the operation on electrical electricity reduction for the University inclusive of the survey on opinions of acceptance and the participants' willingness to follow the plan as shown below:

Stage 1. To review related materials as follow:

1) Documents related to plan on operation on electric electricity reduction for the University as follow

- Annual report on electricity of the University
- Annual of electricity usage and charge
- The entire building plan of the University
- Data on electrical appliance

2) Documents, textbooks involving electricity reduction, statistics and researches

3) Related researches

Copyright by Mahidol University

Stage 2. Field survey on volume, type, size and voltage of light bulbs and air conditioners in the University.

Stage 3. Qualitative research employs focus group method, which is divided into two times:

- First time

This focus group is held to determine the goal and policy among the electricity working groups at the University.

- Second time

This focus group is held to define measures and design implementation plans on the reduction of electricity as a whole with the electricity management sector together with the student council at the University.

Stage 4.

This stage seeks out the opinions on the recognition and behavior on the operation on the reduction of electrical electricity through the use of questionnaires together with the sample population of professors, staff and students.

3.2 Population sampling

3.2.1 Population

Population used in this research are individuals who are involved in electricity uses and working groups in who work in the sector of electricity management at the University. Those people are divided into 6 groups with the total of 10,555 people and the details as stated below:

1. The total of 22 people of the University's electricity saving management group

2. The total of 173 people of the University's electricity saving working group

3. Student council of the University consisted of 11 people

4. Professors of the University consisted of 902 people

5. Academic support staff of the University consisted of 1,395 people

6. Students of the University consisted of 8,052 people

Copyright by Mahidol University

3.2.2 Sample population used in research

Sample population used in this research is the party involved in implementation planning in the reduction of electricity consumption at the University can be classified into 6 groups totaling 991 people according to data collection as will be stated below

1. Sample population in the focus group are:

- The first focus group comprises the Electricity Saving Management Group with the total of 22 people studied from the entire population.

- The second focus group comprises of 20 people from Electricity Saving Working Group. Purposive sampling is used to select specifically the head of the sector; 1 person from each sector totaling 20 people from 20 sectors. Eleven students were selected from the student council at the University taken from the entire population.

2. Sample population that was used for data collection through questionnaire was retrieved from the calculation using the size of the sample group via formula of Krejcie & Morgan, (1970)

$$n = \frac{\chi^2 N p(1-p)}{e^2(N-1) + \chi^2 p(1-p)}$$

n = size of the sample population

N = size of the population

e = the level of deviation of acceptable sampling method

χ^2 = the value of Chi square equals 1 and the confidence level 95% (χ^2=3.841)

p = the proportion of the interested type in population (p = 0.5)

At the confidence level 95 percent and simple random sampling. The sample population consists of 902 professors at Suan Dusit Rajabhat University

Copyright by Mahidol University

$$n = \frac{3.841 \times 902 \times 0.5 \times (1-0.5)}{(0.05)^2 \times (902-1) + 3.841 \times 0.5(1-0.5)}$$

$$n = 269.5963 \approx 270$$

The amount of sample population of the professors at Suan Dusit Rajabhat University = 270 people

1,395 of supporting academic staff at Suan Dusit Rajabhat University

$$n = \frac{3.841 \times 1,395 \times 0.5 \times (1-0.5)}{(0.05)^2 \times (1,395-1) + 3.841 \times 0.5(1-0.5)}$$

$$n = 301.3439 \approx 301$$

The amount of sample population: the group of supporting academic staff = 301 people

367 Students at Suan Dusit Rajabhat University

$$n = \frac{3.841 \times 8,052 \times 0.5 \times (1-0.5)}{(0.05)^2 \times (8,052-1) + 3.841 \times 0.5(1-0.5)}$$

$$n = 366.6552 \approx 367$$

The amount of sample population: students = 367 people

Therefore it can be concluded that the amount of sample population that is used in data collection through questionnaire with the total of 938 people.

The statistics used in data analysis were frequency, percentage, mean, standard deviation.

Copyright by Mahidol University

3.3 Framework and research methods

The implementation plan to reduce the electrical electricity consumption in participation-wise at the University has detailed purpose, method of study, equipment used according to the research guideline as follow:

Table 3.1 Research framework

Objectives	Method of study	Equipment	Data obtained
1. To study the present situation of electricity consumption at the University	1. Study the annual report in the aspect of electricity at the University. - Annual report of electricity - The volume of electricity consumption and annual electricity charges - Plan and measures to reduce existing electricity consumption - Building plan - Electrical appliances - Related researches	1. Document assessment	1. Data on group working in the sector of electricity at the University 2. Volume of electricity usage and annual electricity charges 3. Plan or measures to reduce existing electricity consumption at the University 4. Building details 5. Data on electrical appliances
	2. Data survey - Electrical lamp and air conditioners in 13 buildings at the University	2. Survey from electrical lamps 3. Survey from air conditioners	6 Amount of electrical lamps and air conditioners in each building at the University

Copyright by Mahidol University

Table 3.1 Research framework (cont.)

Objectives	Method of study	Equipment	Data obtained
2. To determine policy along with the goal in the aspect of electricity at the University via participation process	1. Analysis of situation on electricity consumption at the University 2. Summary of problems and the ranking of problems in accordance to importance and identification of limitation on resources, people and budget 3. Determination of policy and goals in terms of collective reduction of electrical consumption	1. The first focus group	1. Policy, goal relating to the reduction of electrical electricity consumption at the University
	4. Determine the measures to reduce the electrical electricity consumption 5. Electricity reduction implementation planning	2. The second focus group	1. The implementation plan to reduce the electricity consumption at the University

Copyright by Mahidol University

3.4 Data analysis

In this research the researcher carried out data analysis in different issues, which are:

3.4.1 Content analysis was used for qualitative data that was obtained from the focus group

3.4.2 The calculation of frequency, percentage, mean and standard deviation was used for quantitative data that was obtained from questionnaires.

3.4.3 Scoring criteria of behaviors electricity use. Scoring is as follows:

Question	Point
Habitual	3
Sometimes	2
Never do	1

Interpretation of the results by the average ($\overline{X}$) is the following criteria as follows :

2.34 - 3.00 means of electricity usage behavior in high level

1.67 – 2.33 means of electricity usage behavior in moderate level

1.00 - 1.66 means of electricity usage behavior in low level

3.4.4 Feedback gathered from the opinion survey. Grouped according to the frequency of the responses. Then present the descriptive analysis.

Copyright by Mahidol University

CHAPTER IV
CURRENT SITUATION OF ELECTRICITY USAGE IN SUAN DUSIT RAJABHAT UNIVERSITY

Due to a rise in number of both students and staff in Suan Dusit Rajabhat University, it is necessary for the University to provide more facilities in order to support the learning and teaching process. Hence, this is why there is an increase in electricity cost. In order to illustrate the necessity to plan for an electricity usage reduction program, this chapter provide a clearer picture of the current electricity usage situation. The situation report was obtained from the following documents: general reports, annual reports on electricity management, annual electricity usage unit reports, electrical equipment information and electricity reduction measurement reports. Other than the mentioned documents, the researcher has inspected air conditioner and light bulbs as well as conducted a survey on electricity usage behaviors. The study can be divided into four categories as follows:

4.1 Current electricity usage situation

4.2 Electrical appliances and equipment

4.3 Electricity saving behaviors of professors, staff and students.

4.1 Current Electricity Usage Situation

Due to an increasing electricity usage trend in Thailand, the government has encouraged its citizens to reduce their electricity usage starting with a project called “Thai Government Officers Unite to Reduce Electricity Usage” in the year 2000 that has continued until today. In 2005, the government has passed a cabinet resolution aims to identify strategies in order to alleviate electricity problem in Thailand. The government has issued measures for every government sector together with state enterprises to reduce their electricity usage by 10 percent as compared to the previous year. The government has also determined a KPI (Key Performance Index) for every

Copyright by Mahidol University

sector. The Office of the Public Sector Development Commission (OPDC) has identified the electricity reduction KPIs for every government sector. On 19 February 2013, the government has passed a cabinet resolution enforcing every government sector to reduce their electricity usage by 10 percent as compared to the previous year. And if there is an increase in electricity usage to more than 15 percent from the previous year from any sectors, the punishment will be a cut on the budget for their next fiscal year. Thus, this has caused every government sector to be more active in reducing their electricity usage (Government Cabinet Resolution Announcement, 19 February 2013)

As Suan Dusit Rajabhat University is an education institution that is under the governance of the Ministry of Education and it was declared to be under the Royal Decree of Designated Building 1995, which must abide by the Electricity Conservation Promotion Act 1995 (Amended in 2007), an electricity management system was implemented at the University in order to reduce cost and reduce the unit of electricity that is imported by the country. Moreover, this system will help to reduce the effects of global warming. However, The University is unable to follow the government's policy which states that every government sector must reduce their electricity usage by 10 percent as compared to the previous year. This is why in 2012, the University has announced an electricity saving policy in order for the staff to micromanage their electricity usage in their particular unit. Electricity saving is considered to be part of the staff's job scope. (the University Announcement regarding Electricity Saving Policy, 25 March 2011)

Copyright by Mahidol University

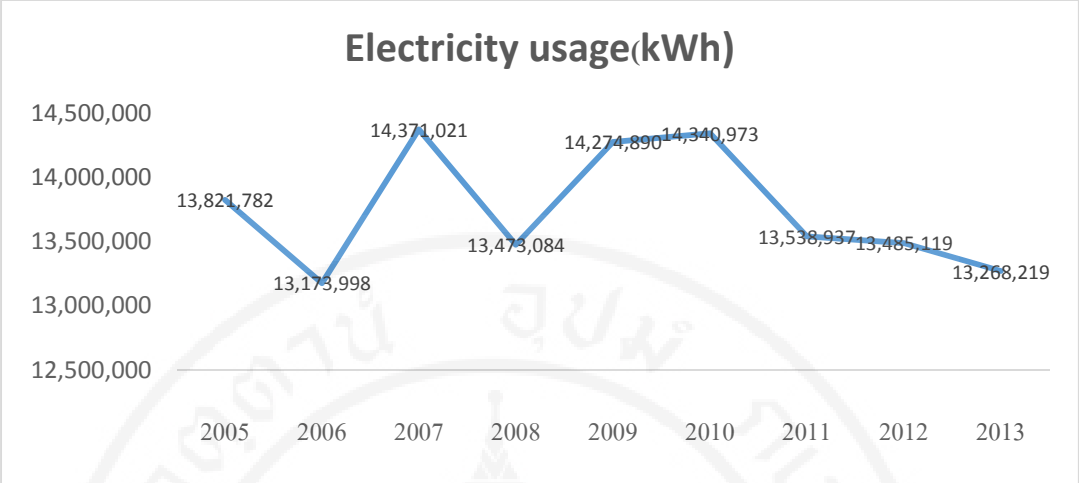

Figure 4.1: Suan Dusit Rajabhat University Current Electricity Usage during 2005-2013

Electricity Unit (kWh)

Source: Suan Dusit Rajabhat University Electricity Reduction Project for the year 2013

From the electricity usage graph of the University, it can be seen that in the year 2011 there has been a reduction in electricity usage. This corresponded to the fact that in that year the University has initiated its electricity reduction policy as well as seriously worked on electricity management program within the university. The University not only published the policy but they have also enforced the policy on every level (Suan Dusit Rajabhat University, 2011)

Suan Dusit Rajabhat University (Only the main campus in Bangkok) contains 9 electrical meter gauges. Since it cannot be determined exactly which meter shows electrical units from which department; hence, the researcher will display an accumulative electricity usage and cost. It was found that in 2005, there was a total electricity usage of 13,821,782 kilowatts/hour and there was a tendency to be increased. In fiscal year 2010, there was a total electricity usage of 14,340,973 kilowatts/hour. After these results were obtained, the electricity saving policy was released. This also includes an electricity reduction project among the government sector. As a result, in fiscal year 2011-2013, there was an apparent drop in electricity usage. In fiscal year 2013, total electricity usage was 13,268,219 kilowatts/hour.

Copyright by Mahidol University

After the University has issued an electricity saving policy in the year 2013, the University has appointed a management body to oversee the electricity saving activities. This is so that the workflow of the electricity saving policy can be done efficiently and effectively. Also, the management body can specify the framework for the policy in order to control the workflow so that they can achieve expected results. The management body comprises the executives from each main department of the university. These executives then appointed another management body which comprises the administrators who will be in charge of each specific department of the university. These management bodies were assigned to coordinate the workflow of electricity saving policy in order for the outcome to be a successful one.

Once there is a clear policy direction and each department has seriously enforced the policy together with a continuous report of electricity saving from the University and the experts from outside the University has recommended ways in which the University can reduce its electricity usage, more people have become active in the electricity saving activities. More people have been seen to turn off electricity, air-conditioner, laptop screens during lunch breaks. Electricity saving program is going in a positive direction and that has resulted in cost reduction for certain fiscal years. Electricity usage which used to be all time high has now decreased; however, the challenge to meet the government's demand of reducing electricity usage by 10 percent as compared to the previous year has not been met. Reasons contributing to this could be because some departments or some personnel still lack of awareness to take this case seriously. They do not feel that they are responsible for this and they still behave how they previously did. For example, some people turn on every light or air conditioner when he/she is working alone in the office.

From the overall picture of electricity usage situation of the University, it can be seen that the reasons contribute to electricity wastes come from 1) air-conditioner (77 percent), 2) lighting system (18 percent) and the rest are from general electronic appliances. An 8 percent electricity usage reduction can be observed and this could be due to a work hour reduction policy whereby the University dictates that every department closes at 19.00. Hence, when the work hour is reduced, in response to that electricity usage will also drop

Copyright by Mahidol University

4.2 Electrical appliances

From studying the annual reports on electricity, electricity unit, annual electricity cost, electricity equipment information, plans and policies to reduce electricity together with inspecting air-conditioner and light bulbs, the following information can be found:

4.2.1 Air-conditioning system

The scope of this research has been identified as an area inside Suan Dusit Rajabhat University. The area contains 13 buildings and there are air-conditioner in every building. The air-conditioning system can be divided as follows:

- Large air-conditioner system or the central unit. The size is 3,600,000 BTU with 15 units. The operating hour is approximately 2,000 hours/year. Total electricity usage is at 5,616,000 kilowatts-hour/year. It is used in buildings or large rooms. Most of the units can still function normally. Their useful life has been more than 15 years.
- Small air-conditioner system or detachable parts. The size of this type of system is between 12,000 – 60,000 BTU with a total of 99 units. Most of them have a useful life of more than 15 years in some cases up to 20 years. There are about 174 units or 18 percent that has the Electricity Label No. 5 stickers on them.

Most of the air-conditioners in the University have exceeded their lifespan, which is why they require more power to function. The efficiency of the air-conditioner does not coincide to the size of the room and they do not have the Electricity Label No.5 stickers on, which makes them waste more electricity. Upon installing detachable air-conditioner, the problem that was encountered was the collision of hot and cold coils. The effect of this is the air-conditioner will have to double its power as it blows heat at each other. When calculating air-conditioner usage in the University that has been turned on for 6 consecutive hours, it was found that the total electricity usage was at 10,578,980 kilowatts-hour/year.

In order to help preserve the electricity, we can regularly check for the maintenance of electrical appliances as well as replace the ones that exceed their lifespan. Preserving the electricity requires many factors combined whether it’s behaviors, conscious and using equipment that can support electricity saving. Thus,

Copyright by Mahidol University

improving an entire air-conditioner system is one of the goals that the University has set to achieve. However, one obstacle that would prevent the University from achieving that specific goal is the large sum of budget that will be required to use for this project. In order to help save cost, performing basic maintenance operation for the air-conditioner such as clean it according to the timeline will help to reduce electricity cost as well.

4.2.2 Lighting System

Most of Suan Dusit Rajahbat University lighting system is fluorescent lights the size of 40 watts with a total of 13,428 units. The useful life is around 2,000 hours/year. Around 1,300 units or around 10 percent are electricity saving light bulbs T5 where the Electricity Generating Authority of Thailand has replaced them for the university.

Nonetheless, many fluorescent lights exist. According to a summary report from a management body of the University electricity management team, it was found that electricity waste from air-conditioning system accounts for 77 percent, electricity waste from lighting system accounts for 18 percent and the rest is from electronic appliances.

As for the limitations that the University's facilities have towards electricity savings, it was found that the University buildings are opaque. Some of the rooms do not contain windows or proper ventilation system. Hence, this is the reason why the air-conditioner must be on all the time. For certain rooms, the size of electrical appliances and the room size are not proportionate. Moreover, there is insufficient budget for improving and fixing electrical appliances with high useful life that takes up high electricity volume. Another thing is staff and students bring in their personal electrical appliances to use at the University's facilities, especially inside the classroom. Those appliances include: television, radio, refrigerator, electronic boiler, fans, communication devices etc. It is important to note that only a few of these mentioned appliances have the Electricity Label No. 5 on them.

Copyright by Mahidol University

4.3 Electricity Saving Behaviors of Professors, Staff and Students

A study about electricity saving behaviors of professors, staff and students of Suan Dusit Rajabhat University was conducted and information was collected from questionnaires asking about their awareness level regarding the electricity saving news and their electricity usage behaviors. The questionnaires were distributed to professors, staff and students of the University. The sample size proportion can be referred to CHAPTER 3, consisting of 967 questionnaires. The researcher has collected the complete results to analyze according to the statistical methods. The results can be divided into 4 parts as follows:

4.3.1 General information of the sample group

4.3.2 Awareness regarding electricity saving news

4.3.3. Relationship between independent variable that has been studied to the awareness level of electricity saving news

4.3.4 Electricity saving behaviors among professors, staff and students

4.3.1 General information of the sample group

There are a total of 967 samples for the sample group. Out of these 967 samples, 293 samples (30.30 percent) are professors, 305 samples (31.54 percent) are staff and 369 samples (38.16 percent) are students, as shown in table 4.1

Table 4.1 Amount and percentage of the sample group divided according to their roles

Roles	Amount	Percentage
Professors	293	30.30
Staff	305	31.54
Students	369	38.16
Total	967	100.00

Copyright by Mahidol University

4.3.2 Awareness of electricity saving news, the awareness level regarding electricity saving news can be analyzed and results can be found as follows:

1. Professors, staff and students are all aware about the electricity saving news and their awareness goes in the same direction. That direction is they are aware of the news or have been aware of the news. Television is the source of media that made them aware of the news the most. 844 samples (87.28 percent) received news via television. 786 samples received news via pamphlets/brochures (81.28 percent). 692 samples received news via the Internet (75.65 percent) and when studying the relationship between to receive news and information about government policies on the management of energy consumption. By using the chi-square (Chi-Square) can conclude that. The status of the samples were correlated with the perception of information on electricity efficiency. Statistically significant at the 0.05 level. (Appendix E)

2. When it comes to the awareness level regarding government electricity management policy, it was found that professors, staff and students were made aware about government electricity management policy via television the most. 836 samples received news about government electricity management policy via television (86.45 percent). 794 samples received news via pamphlets/brochures (82.1 percent). 755 samples received news via newspaper (78.07 percent) and when studying the relationship between the status of a sample of the knowledge, information about state policy on the management of energy consumption. By using the chi-square (Chi-Square) can conclude that. The status of the samples were correlated with the perception of information about the state policy in the field of energy management. Statistically significant at the 0.05 level. (Appendix E)

3. Professors, staff and students are made aware of electricity saving news in the University in the same direction. They are made aware via billboards/posters the most. 701 samples (77.98 percent) were made aware via billboards/posters. 647 samples (71.97 percent) were made aware via activities organized by the university. Those activities include: “Suan Dusit Spirit Unite Suan Dusit Souls Help to Save Electricity.” This activity took place within the university’s ground in order to encourage executives and staff of the University to help save electricity. The method is simple. People must follow these 3 basic steps, which are

Copyright by Mahidol University

turn off the lights, adjust the air-conditioner and unplug. This activity which took place on 4th April 2014 had students parading all over university in order to raise more awareness and to provide more knowledge about electricity saving for professors, staff and students. Other than being made aware of electricity saving news in the University via billboards/posters, another medium that can get to people is via public announcement. 422 samples (46.94 percent) were exposed to the news via public announcement. The study of the relationship between the status of a sample of the knowledge, information, energy saving of Suan Dusit Rajabhat University. It is concluded that the status of the samples were correlated with the perception of information, the energy efficiency of Suan Dusit Rajabhat University. Statistically significant at the 0.05 level. (Appendix E)

4. The media where professors, staff and students would like to receive news regarding electricity saving the most would be via billboards/poster. 832 samples (86.04 percent) responded billboards/posters. According to the 745 respondents (77.04 percent), second from billboards/posters would be via organized activities. The third medium according to the 676 respondents (69.91 percent) would be from is via Social Media such as Facebook and Line. The study of the relationship between the status of a sample to the dissemination of information. Knowledge or activities to save electricity of Suan Dusit Rajabhat University. It is concluded that the status of the samples associated with the dissemination of information. Knowledge or activities to save electricity of Suan Dusit Rajabhat University. Statistically significant at the 0.05 level. (Appendix E)

The sample group has expressed further that it would be advantageous for them if they were made aware of the news as they would be able to gain more knowledge and understand things correctly regarding the topic of electricity saving. After they are given an accurate piece of information then they can actually apply theories into practice. News is one of the decision making factors that will lead them to take actions on many aspects in their lives. Hence, by receiving news from various media such as public announcement, Internet, billboards, posters, activities, government official announcement, and the university's social media platforms would help to encourage them to save electricity. This corresponded to the research of Kanchana Sornkaewdara (2003 : 77) and Jullada Chaihuatcharoen (1993). They did a

Copyright by Mahidol University

study on factors that influenced electricity saving behaviors of housewives and it was found that by receiving news about electricity saving via the media, those housewives were encouraged to save electricity.

The result as shown on the table 4.2 :

Table 4.2 : Awareness of electricity saving news

News Source		**Amount**	**Percentage**
1. Awareness regarding electricity saving news			
- Awared/Has been awared		967	100.00
- Has never been awared		-	-
1.1 Awareness regarding electricity saving news via the media (Each Question allowed more than one answer)			
-	Television	844	87.28
-	Newspaper	671	69.39
-	Radio	455	47.05
-	Pamphlets/ Brochures	786	81.28
-	Internet	692	75.56
-	Word of mouth	611	63.19
2. Awareness regarding electricity management policy issued by the government			
- Aware/ Has been aware		967	100.00
- Has never been aware		-	-

Copyright by Mahidol University

Table 4.2 : Awareness of electricity saving news (cont.)

News Source		**Amount**	**Percentage**
2.1 Awareness regarding electricity management policy issued by the government via the media (Each Question allowed more than one answer)			
-	Television	836	86.45
-	Newspaper	755	78.07
-	Radio	611	63.19
-	Pamphlets/ Brochures	794	82.11
-	Internet	750	77.56
-	Work place	611	63.19
-	Seminars/Meetings	725	74.97
3. Awareness of electricity saving news from Suan Dusit Rajabhat University			
- Awared/ Has been awared		899	92.97
- Has never been awared		68	7.03
3.1 Awareness of electricity saving news from Suan Dusit Rajabhat University via the media (Each Question allowed more than one answer)			
-	Posters/ Billboards	701	77.98
-	Pamphlets/ Brochures	311	34.59
-	Public Relations within the university	422	46.94
-	Organized activities	647	71.97
-	Government official letters/ Memorandum	184	20.47
-	Meetings/ Seminars	179	19.58

Copyright by Mahidol University

Table 4.2 : Awareness of electricity saving news (cont.)

News Source		Amount	Percentage
4. The need to receive news, knowledge, activities regarding electricity saving information from Suan Dusit Rajabhat University			
- Does not need		-	-
- Need		967	100.00
4.1 The need to receive news, knowledge, activities regarding electricity saving information from Suan Dusit Rajabhat University via the media (Each Question allowed more than one answer)			
-	Posters/ Billboards	832	86.04
-	Pamphlets/ Brochures	561	58.01
-	Activities	745	77.04
-	Government official letters/ Memorandum	481	49.74
-	Public announcement within the university	613	63.39
-	Meetings/ Seminars	539	55.74
-	E-mail	371	38.37
-	Social media e.g. Facebook, LINE etc.	676	69.91

4.3.3. Relationship between independent variables that are being studied and the awareness level of electricity saving news. The study of the relationship of independent variables, which are the status of the sample group and the awareness level of electricity saving news was conducted using statistical Chi-Square method. The results are as follows:

Copyright by Mahidol University

Table 4.3 : Values of Average Standard deviation following 16 behaviors in Electricity Saving of Professors, Staff and Student

Electricity Saving Topics	Professors		Staff		Students		Overall	
	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
1. Your department turns off lights during lunch hours	2.18	.388	2.28	.451	1.88	.909	2.10	.674
2. You turn off the lights and electrical appliances every time you finish using them	2.79	.407	2.67	.473	2.08	.265	2.48	.500
3. Your department sets the air-conditioner temperature at 25-26 degrees Celsius	2.39	.488	2.76	.427	1.47	.651	2.16	.777
4. Your department sets the time for turning on the air-conditioner in the morning to be from 9.00-12.00 and in the afternoon from 13.00-16.30	2.34	.476	2.53	.851	2.91	.282	2.62	.621
5. You always switch off lights and electrical appliances after office hours and after classes	2.63	.483	2.49	.501	2.00	.000	2.35	.476
6. You will use staircase instead of elevator when going up and down one floor	2.04	.782	2.36	.480	1.92	.265	2.10	.564
7. You always shut down computers and turn off printers when they are not in use	2.25	.639	1.70	.461	2.00	.000	1.98	.489
8. You double check the information on the screen before ordering it to print	2.39	.489	2.00	.000	1.57	.738	1.96	.627
9. You do not plug in electrical cords of electrical appliances all the time	2.63	.483	2.57	.496	2.00	.000	2.37	.483

Copyright by Mahidol University

Table 4.3 : Values of Average Standard deviation following 16 behaviors in Electricity Saving of Professors, Staff and Student (cont.)

Electricity Saving Topics	Professors		Staff		Students		Overall	
	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
10. You always close the refrigerator properly after using it	3.00	.000	3.00	.000	3.00	.000	3.00	.000
11. You do not immediately put heated food into the refrigerator	2.09	.280	2.28	.447	2.00	.000	2.11	.316
12. You try to utilize natural lighting as much as possible	1.60	.490	1.79	.410	1.89	.308	1.77	.419
13.You always close the door every time you leave or enter the room that has an air-conditioner turn on	2.50	.501	2.00	.000	2.08	.265	2.18	.385
14. You do not wear thick layer of clothes in a room that has an air-conditioner on as that would cause the air-conditioner to use more cooling power	2.61	.488	2.00	.000	2.00	.000	2.19	.389
15. You send emails instead of hard copy mails	2.00	.000	2.40	.490	2.48	.500	2.31	.462
16. You set the computer to turn off its screen when not in used for more than 15 minutes	2.39	.488	2.64	.480	1.51	.651	2.13	.745

From the study of electricity usage among professors, staff and students, it was found that the sample group has a mid-range of electricity saving behaviors. When looking deeper into each topic, it was found that the issue about “closing the refrigerator door properly every time you finish using it” has the highest average and has the highest range of electricity saving behaviors. Second from closing the refrigerator door properly is “you do not plug the electrical cords of the electrical

Copyright by Mahidol University

appliances all the time" and "turn off the lights and electrical appliances after office hours and classes" consecutively,

When taking a closer look for each group of status, it was found that professors, staff and students follow the following electrical usage behaviors. The result of each status is divided as follows:

Professors

Professors have high electricity saving behaviors almost on every topic. "Closing refrigerator door properly after using" is the topic with the highest average rate. Second to that is the topic of "do not plug electrical cord all the time" and "turn off the lights and electrical appliances every time after office hours and after classes" consecutively.

Under the topic of lighting system it was found that every department switched off lights every time after office hours. However, only some departments turn off lights during lunch break. Nonetheless, this serves as a great example for other departments. Even though, the University has issued electricity saving policy but there are only a handful of professors who try to save electricity by utilizing natural lighting as much as possible.

Under the topic of air-conditioner system it was found that professors have high electricity saving behaviors especially in the following areas: "do not wear thick clothes in the room with the air-conditioner turns on" and "close the door every time you enter or exit the room with air-conditioner turns on". The air-conditioner temperature has been set to between 25-26 degrees Celsius. Some departments are able to determine the time when the air-conditioner must be turned on, which is between 9.00-12.00 in the morning and between 13.00-16.30 in the afternoon.

Under the topic of using elevator it was found that their electricity saving behavior for "using staircase instead of an elevator when going up and down one floor" is in the mid-range.

Under the topic of using computers and printers it was found that professors' behavior of checking their content on screen before printing is high. Professors' behaviors to shut down the computers and turn off printers when not in used are in the mid-range. Their behavior to send official letter via the E-Office

Copyright by Mahidol University

system instead of using paper is in the mid-range. In terms of computers that are used for teaching purposes, they will be turn on from morning until the last teaching hour. As students do not feel the sense of shared responsibility and they do not realize the importance of electricity saving together with the university's direction to provide free computer notebooks to students since 2006, almost every student owns a personal laptop. Laptops are one of the reasons that causes a rise in the university's electrical cost. Other than laptops, students also carry other electronic devices such as mobile phones, smartphones and tablets. During the course of each lesson, students would charge their personal electronic devices in the classroom or in the area where there are electrical sockets provided by the university.

Under the topic of electrical appliances it was found that professors will switch off televisions in when no one is watching it in the department. However, there is a lack of adjustment on screens that are too bright and the electrical cords are connected to the sockets at all time in order for the convenience of turning it on the next time. As for public televisions, they are all connected in one system; hence, some of them remain on even when that area is already closed e.g. the television in Kitchen 12. Despite the kitchen being closed but the television remains on.

Under the topic of refrigerator it was found that behavior with the highest average is "closing the refrigerator door properly after used". Other behaviors where professors have taken actions in order to help save electricity that relates to the refrigerator includes: "do not immediately put heated food into the refrigerator", "adjust the refrigerator temperature accordingly" and "use refrigerator with Electricity Label No.5 stickers."

Under the topic of electrical kettle it was found that the behavior professors have taken is keeping the plug connected to the sockets and they do not unplug the moment the water is boiled as they claimed that it is for their convenience.

Staff

The electricity saving behaviors of staff range between medium to high. The behavior that receives the highest average is "close the refrigerator door after finishes using", the second highest topic is "every department to adjust their air-conditioner temperature at 25-26 degrees Celsius" and "turn off the lights and

Copyright by Mahidol University

electrical appliances after finishes using" consecutively. Their behaviors can be further analyzed by dividing into each category of electrical appliances as follows:

Under the lighting system category, it was found that the behavior that ranks the highest is "switch off the lights and electrical appliances once finish using". Second from the rank is "switch off the lights during lunch breaks", which is considered to be a good behavioral example for other departments. Even though, the University has launched the electricity saving campaign but only a handful number of staff has tried to save electricity by utilizing the most of natural lightings.

Under the air-conditioner system category, it was found that staff's attitude to save electricity is as high as professors. Each department has set their air-conditioner temperature to be between 25-26 degrees Celsius. Some departments are able to specify the turning on time of the air-conditioner, which is between 9.00-12.00 in the morning and 13.00-16.30 in the afternoon. However, it is also important to note that there are some departments whose working hours are different from other departments, which are Suan Dusit Place Hotel and Dusit Poll Center; hence these offices have to operate beyond regular work hours. Moreover, the following behaviors ranked as medium: "do not wear thick clothes when sitting in a room with air-conditioner turns on" and "always close the door when enter or exit the room with air-conditioner turns on". The reason that the behavior of "do not wear thick clothes when sitting in a room with air-conditioner turns on" ranked in the mid-range is because sometimes the staff must wear suits in order to look more formal.

Under the elevator category, it was found that the staff's behavior of "using staircase instead of an elevator when going up and down on floor" ranked in the mid-range.

Under the computer and printer category, it was found that staff's behavior of "setting the computer to turn off automatically when not in used for more than 15 minutes" ranked the highest. Another behavior that ranked high is "sending notes via an official system of E-Office in order to reduce the use of paper". The behavior that ranked in the mid-range is "check information on screen before printing" and "switch off computers and turn off printers when not in use".

Copyright by Mahidol University

Under the electrical appliances category, it was found that in departments that have television, staff turn off the television when no one is watching it; however,

there is a lack of screen adjustment when the screen is too bright. Moreover, the television electrical cord stays connected to the socket as it is claimed to be convenience the next time someone wants to turn the television on. As for public televisions, they are all connected in one system; hence, some of them remain turned on even when that area is already closed e.g. the television in Kitchen 12. Despite the kitchen being closed but the television remains turned on.

Under the refrigerator category, a behavior that receives the highest average is “closing the refrigerator door properly after used”. Other behaviors include: “do not immediately put heated food into the refrigerator”, “adjust the refrigerator temperature accordingly” and “use refrigerator with Electricity Label No.5 stickers.

Under the electrical kettle category, it was found that the behavior staff have taken is keep the plug connected to the sockets and they do not unplug the moment the water is boiled as they claimed that it is for their convenience.

Students

The electricity saving behaviors of students lie mostly in the mid-range. The topic that receives the highest average is “turning on air-conditioner at 9.00-12.00 in the morning and 13.00-16.30 in the afternoon”. Normally, there will be staff stationed at each building in order to open and close the building according to the time assigned by the university. Another behavior that students have taken is to send homework or reports via emails instead of sending them on hard copies.

The results of their behaviors can be divided according to the category of electrical appliances as follows:

The rate of students’ behaviors towards electricity saving is between medium to low and this is due to the fact that students are not aware about how important electricity saving is as well as they do not feel the sense of shared responsibility. When looking at the lighting system, it was found that once students finish their lessons and about to leave the classroom only a handful number of them would behave in a way that would help save electricity and air-conditioner. Students’ behaviors towards saving electricity is low as can be seen that they have turning on the lights for the maximum number of hours. This means that they turn on the lights from the beginning of the lesson until the end. In terms of computers and printers usage, it

Copyright by Mahidol University

was found that students' behaviors towards turning computers and printers off when not in used are in the medium range. Students' behavior towards setting their screen to turn off automatically when not in used for more than 15 minutes are in the low range. Another behavior that is in the low range is students' behavior of checking their information on screen before ordering for a print out. For computers that are used for educational purposes, once they have been turned on in the morning they will be on until the time when the last lesson ends. Moreover, due to the university's policy of distributing free computer notebooks for students since 2006, every student owns a laptops. The purpose of using their laptops are both for education and leisure. Other than laptops, students also carry additional electronic devices such as mobile phones, smartphones and tablets. During lessons, students would charge their devices at the sockets inside the classroom or in areas where the University provides free sockets. This is one of the reasons that has caused a surge in electricity bill for the university.

When looking at students behaviors of using an elevator, it was found that their behavior of "using staircase instead of an elevator when going up or down one floor" ranked in the mid-range.

From the observation of electricity saving behaviors among professors, staff and students of the University, it has shown that every citizen inside the University is quite active and participatory when it comes to the matter of electricity saving. However, there existed a certain group of people who are still ignorant towards the situation. They do not feel the necessity to take part in saving electricity and neither do they feel the sense of shared responsibility. They do not see the consequence that will happen to the campus in the long run if they do not start saving electricity now. Some of the behaviors that this group of people still cling on to are such as turn on the lights and air-conditioner when sitting alone in the room, does not turn off the computer screen when not in used etc.

Management, professors, staff and students should have the knowledge about electricity saving. Students, especially, is the most crucial group of citizens inside the University as students can help to educate their friends about electricity saving and they can develop the campaign and turn it into the university's culture in the future.

Copyright by Mahidol University

The factor that will cause a sustainable decrease in electricity usage of the University consists firstly of citizens inside the university, including students. Everyone should use electricity wisely and efficiently. They should be conscious when using electricity and they should realize that it is important for everyone to share the responsibility of saving the electricity and develop that sense of responsibility in order for it to be ingrained as an organization's culture. The method uses to save electricity should be easily passed on from one generation to the other. The process of educating and supporting should always be there. Moreover, monitoring the result and evaluating the performance of the electricity saving campaign should be done consistently. In the end, the long term objective for staff and students of the University is to have an eternal conscious that they should save electricity at university equally as how they do it at home. Lastly, is to turn that conscious into organization's culture of saving electricity.

Copyright by Mahidol University

CHAPTER V
ELECTRICITY REDUCTION POLICIES, MEASURES, AND IMPLEMENTATION PLANS OF SUAN DUSIT RAJABHAT UNIVERSITY

According to the electricity saving policy issued by the government, Suan Dusit Rajabhat University accepted the policy and applied the policy throughout the entire university yet they have not been able to achieve the objective set out by the government. When studying the current electricity usage trends in the University, it was found that despite a decrease in electricity usage during the time where the electricity saving policy was implemented the University is still not able to reduce its electricity usage by 10 percent as compared to the previous year. Furthermore, electrical appliances that require more electricity power such as air-conditioners and lighting systems have exceeded their operating lifetime. Some of the air-conditioners are constantly malfunctioning but none of them have been replaced. In terms of the light bulbs, the Electricity Generating Authority of Thailand have replaced them into the T5 type; however, the majority of them are still the large size fluorescent type (T12, T8)

In order for the University to achieve its objective, they must develop a concrete implementation plan. The information in this CHAPTER will shed light on the pre-plan process and the planning process of the participative electricity reduction actions. Below are the details

5.1 Electricity reduction policies

5.2 Determination of electricity reduction measures

5.3 Electricity reduction implementation plans

5.4 Suggestions of group discussions

Copyright by Mahidol University

5.1 Electricity reduction policy

Suan Dusit Rajabhat University has accepted the electricity reduction policy from the Ministry of Electricity and has adopted it as part of the university's policy in 2014. Almost every university or government institution have adopted this policy into their organization. This policy serves as a big framework whereby the other government organizations can use to imitate. There are 6 items to the policy as follows:

5.1.1 Considering and improving electricity reduction policy for the university

1. To suitably improve the electricity management system to ensure that it conforms with the law and other related regulations

2. To continuously improve the efficiency of the organization's electricity usage to ensure it is suitable to work.

3. To formulate the plan and goals to conserve electricity for each year and communicate them to all the personnel in order for them to understand and execute accordingly.

4. Electricity conservation is the responsibility of the executives in all levels and all the personnel to cooperate in following the stipulated measures, monitor, inspect and report to the Electricity departmental sector.

5. To provide support to various aspects such as human resource, budget, working hours, training and participatory contribution on presentation, suggestions on developing the work on Electricity.

6. The executives and the Electricity working group should revise and improve the policy, goal and implementation plan on Electricity for each year.

Because the policy that has been previously mentioned was passed down from the Ministry of Electricity; hence, the policy was written in a broad manner so that the organization can customize the policy and apply it in their own way. According to the policy, it was stated in the last item that executives including electricity management body should revise and enhance the policy on a yearly basis. However, for the University, the policy has never been revised. Thus, this could be

Copyright by Mahidol University

one of the reasons that explains why the University has failed to achieve the objective set out by the government.

5.1.2 Group discussion to determine electricity reduction objective and policy

This group discussion was organized in order to brainstorm for ideas from executives who are in the university's electricity saving management group. The main agenda was to evaluate the university's electricity reduction policy and to determine whether the policy needs to be changed or improved. More topics to the discussion includes: determining the electricity reduction target and providing useful comments for the group.

The result of the group discussion from the electricity saving management group of Suan Dusit Rajabhat University in order to determine the objective and mutual policy was that before the policy was implemented the overall picture of electricity usage in the University was high. However, once the policy has been issued and the electricity management body was clearly appointed since 2011, electricity reduction trend has been positive. In certain fiscal years, the electricity cost was decreased as well as an improved in electricity usage can be seen. This means that the usage unit gotten lower. However, the University fails to achieve the objective set by the government which is to reduce electricity usage by 10 percent as compared to the previous year. Reason contributing to this could be because in certain departments the personnel are not able to drop the old habit of wasting electricity. One of the habits is turning on air-conditioner when working alone in a room. According to Mr. Punsavachara Udomsetchai, person in charge of the electricity for Suan Dusit Rajbhat University, it was found that reasons contributing to electricity wastes come from air-conditioners, which accounts for 88 percent. Lighting system, which accounts for 17 percent and the rest come from general electronic appliances.

In terms of the University's limitation when it comes to electricity saving, it was found that buildings inside the University are opaque. Some of the rooms do not come with windows or proper ventilation system, which is why the air-conditioner must be on all the time. Some of the electrical appliances are not proportionate to the room size. Moreover, the University does not have sufficient budget for improving

Copyright by Mahidol University

electrical appliances with long useful life that run on high electricity volume. The university's personnel are aware of the topic of electricity saving but they do not see the necessity of actually taking actions to save electricity. Furthermore, they do not establish a sense of mutual responsibility as they have failed to see the impact that will happen to the University in the long run if they do not act now.

The electricity saving management group believes that the University's electricity saving policy is appropriate but their suggestion is to adjust the policy so that it falls under the context of the University itself. The University should also encourage more participation from students so that they can help to save electricity inside the university.

Criticisms: The electricity saving management group should interpret the policy so that they fully understand the meaning of it. This is so that they can fully utilize and apply the policy in real life. The reason such criticism has been pointed out is because according to the 6 items on electricity saving, the language used is difficult to understand. They cover a wide range of area and is hard to pinpoint what those items actually refer to.

5.1.3 Electricity reduction objective for Suan Dusit Rajabhat University

The participants of the discussion group has determined electricity reduction objective for the University and the objective is for Suan Dusit Rajabhat University to reduce electricity usage by 10 percent as compared to previous year starting from fiscal year 2014. This objective is expected to be achieved within 3 years.

Criticisms: Other than setting up an objective of reducing electricity usage, other objectives should also be taken into considerations. Another objective can be to identify the percentage of the reduction rate for electrical appliances with long useful life, low quality but consumes more electricity.

Copyright by Mahidol University

5.2 Determination of electricity reduction measures

5.2.1 Electricity reduction measures of Suan Dusit Rajabhat University

According to Suan Dusit Rajbhat University announcement with regards to electricity saving policy (2014) puts in effect on 7 March 2014, electricity reduction measures consist of the followings:

1. Turn air-conditioner on and off at the following time: 8.30-12.00 and 13.00-16.30

2. Do not turn air-conditioner on after regular office hour except that department has to work on public holidays

3. Turn air-conditioner on 15 minutes prior to the meeting and it off immediately once the meeting is over

4. Turn air-conditioner off when there is no one working in the room or when someone is leaving the room for a long time

5. Adjust air-conditioner temperature to be at 26 degrees Celsius

6. Use the staircase instead of using an elevator when going up and down one floor

7. Turn off every lights after finishes using the office, kitchen, meeting rooms and toilets

8. Turn off electrical appliances right after finishes using as well as unplug

9. Turn off computer screen when not in used for more than 15 minutes and unplug immediately after finishes using

Additional announcements from the University with regards to electricity saving were made on 7 August 2014 as follows:

1. Time to open-close the university's gate and facilities' doors are as follows:

Copyright by Mahidol University

1.1. Education buildings and office buildings to be opened at 06.00 and to be closed at 19.00

1.2. The university's gate is to be closed at 19.00 except gate no.5 (Ratchavithi Rd.). Gate no.5 is to be closed at 21.00. During 19.00-21.00 mobile traffic barriers are to be used as gates for cars to enter and exit university's premises

1.3. In case that some departments organize an activity after 19.00, that department must write an official letter to ask for permission. And the group of people who can grant permission should be the director of the dean's office and the director of buildings and venues

2. Turn off lights, air-conditioner and computer's screen from 12.00-13.00 in order to reduce electricity usage for at least 1 hour/day. And if no one is in the office building for a long time, electrical appliances should all been switched off.

3. An exception is granted to special business units so that they do not have to follow items number 1 and 2

4. The above mentioned electricity saving policy is to be applied to education center and education and local research center that are situated outside the university's premises as well.

It can be seen that electricity reduction measures do not reflect the 6 items of electricity saving policy. This is because they are more of a measure that aims to encourage personnel to save electricity in different department. Also, every measure is established based only on the first two items of the electricity reduction policy; which are

Policy number 1: To suitably improve the electricity management system to ensure that it conforms with the law and other related regulations

Policy no. 2: To continuously improve the efficiency of the organization's electricity usage to ensure it is suitable to work.

When taking a closer look at all the measures it can be seen that policy 3-6 were not integrated as part of the measures. Hence, for the second group discussion, the researcher thinks that the topic should be about determining electricity reduction measures so that they cover all of the 6 items of the policies.

Copyright by Mahidol University

5.2.2 A group discussion to formalize an implementation plan to reduce electricity usage

When the discussion has reached consensus to determine the goal and to retain the original policy on reducing the electricity usage without any alterations or improvements. The researcher then coordinates with the team from the Electricity working group to stipulate the measures together by taking into account the university's original policy. The details of the policy and the measures that have been jointly discussed from the group discussion are as follow:

Policy number 1: To suitably improve the electricity management system to ensure that it conforms with the law and other related regulations

Measure

1. To separate the electricity meter of each building
2. To study the investment on installing the solar panels on the roof as well as on the rooftop.
3. To brainstorm ideas to allot work hours to avoid peak hours (9:00 a.m.-9:30 p.m.)

Second policy: To continuously improve the efficiency of the organization's electricity usage to ensure it is suitable to work.

Measure

1. To improve the air-conditioning system
2. To improve the lighting system
3. To improve the efficiency of office automation

Remarks

1. There should be a better interpretation of the following statement

" To continuously improve the efficiency of the organization's electricity usage to ensure it is suitable to work." What does this sentence imply and what are the criteria to measure the suitability? Once this statement is clarified, only then would the second policy be reached to determine the measures.

Third policy: To formulate the plan and goals to save electricity for each year and communicate them to all the personnel in order for them to understand and execute accordingly.

Copyright by Mahidol University

Measure

1. To increase the communication efficiency on the reduction of the university's electricity usage.

2. To hold a meeting to plan the reduction of electricity usage and set a goal for each sector.

Fourth policy: Electricity conservation is the responsibility of the executives in all levels and all the personnel to cooperate in following the stipulated measures, monitor, inspect and report to the Electricity Department.

Measure

1. The "Watchful eye project"

Fifth policy: To provide support to various aspects such as human resource, budget, working hours, training and participatory contribution on presentation, suggestions on developing the work on Electricity.

Measure

1. To train on the reduction of electricity usage at work

2. To train the students on the reduction of electricity usage in the classrooms and laboratory.

3. To survey the opinions on the subject of reduction of electricity usage in university.

Sixth policy: The executives and the Electricity department should revise and improve the policy, goal and implementation plan on Electricity for each year.

Measure

1. To hold a meeting to brainstorm ideas on determining the restriction or to improve the policy, goal and plan involving the reduction of electricity usage.

Copyright by Mahidol University

5.3 Electricity reduction implementation plan

The brainstorming process to determine the measures to reduce electricity usage in university has led to the utilization of measures in various plan constructions, which can be combined, into an implementation plan to reduce electricity usage in Suan Dusit Rajabhat University. Each plan contains the following details

Table 5.1 The separation of electricity meter of each building

Name of implementation plan: 5.3.1 The separation of electricity meter of each building				
Objective: To classify the expense on Electricity for each building or each sector. This is to inform each sector about the details on their electricity usage and to bring out awareness in the reduction of electricity usage.				
Goal: To be able to separate electricity meter in every building or every sector.				
Responsible person: Buildings division				
Number	**Activity**	**Responsible person**	**Duration**	**Expected outcome**
1	To inspect the electric wires that enter the building for all the 9 electricity meters to find out where each meter distribute the power to	Buildings division	3 months	To know the locations where all the 9 meters distribute the electricity to

Copyright by Mahidol University

Table 5.1 The separation of electricity meter of each building (cont.)

Name of implementation plan: 5.3.1 The separation of electricity meter of each building				
Objective: To classify the expense on Electricity for each building or each sector. This is to inform each sector about the details on their electricity usage and to bring out awareness in the reduction of electricity usage.				
Goal: To be able to separate electricity meter in every building or every sector.				
Responsible person: Buildings division				
Number	**Activity**	**Responsible person**	**Duration**	**Expected outcome**
2	To study the suitability and pattern of electricity meter installment	Buildings division/ representatives from various sectors in the University	3 months	To obtain the new pattern of electricity meter installment. Whether to install in each building respectively or to separate sector wise. (Some buildings have various sectors located within them)
3	To install separate electricity meters	Buildings division	1 year	To install electricity meter according to the restrictions.

Remarks

1. There should be a clear stipulation on the time duration; from when until when and the total duration it would take for completion. If written tentatively this way, it would be difficult to draw the boundary for work.

Copyright by Mahidol University

2. There should be an approximation of budget since it is a enormous issue which might require a colossal sum of money.

Table 5.2 The study on the investment on the installation of solar panels on the roofs and the rooftops

Title of implementation plan: 5.3.2 The study on the investment on the installation of solar panels on the roofs and the rooftops				
Objective: To study the possibilities to install the solar panels on the roofs and the rooftops.				
Goal: To obtain the way to make decision on the investment on solar panel systems on the roofs and the rooftops.				
Responsible person: Buildings division				
Number	Activity	Responsible person	Duration	Expected outcome
1	To study the worthiness, break-even point in installing the solar panels	Buildings division	6 months	To know the worthiness from installing the solar panels on the roofs and the rooftops.

In reference to the framework, there is an attempt to look for alternative source of electricity for the future. Even though, the University has a limited space, there are still available spaces on the rooftop of each building. If a study is carried out on the worthiness in careful investment and the investment on the installations, it would decrease the expense on electricity substantially.

Remarks

This plan must incorporate the study of initial capital and the return carefully because solar panel system on the roof has high initial cost of setting up. When an elaborate study is done, this would benefit the decision making of the executives in terms of operations.

Copyright by Mahidol University

Table 5.3 The brainstorm of ideas for time allotment to prevent peak hours (9:00 a.m. – 10:00 p.m.)

Title of implementation plan: 5.3.3 The brainstorm of ideas for time allotment to prevent peak hours (9:00 a.m. – 10:00 p.m.)				
Objective: To allocate activities that can be arranged in the time duration that is not within the high electric bill period (9:00 a.m. – 10:00 p.m.) For example, turn on the water pump before 8:00 a.m.				
Goal: The personnel				
Responsible person: Buildings division				
Number	Activity	Responsible person	Duration	Expected outcome
1	To hold a meeting to brainstorm ideas to allocate activities that can take place within the low electric bill period.	Buildings division	1 month	Each division receives an activity that can be arranged either before or after the peak hours.

In reference to the framework, this implementation plan will help to allocate which activity could be postponed to operate either before or after peak hours or during 9:00 a.m. – 10:00 p.m. However, during the peak hours or from 9:00 a.m.- 10.00 p.m. is the period that involves a vast usage of electricity resulting in the Electricity Authority to increase the cost of the demand on electricity which costs between 220- 332 baht per kilovolt (depending on the voltage). Apart from this period, there is no cost incurred.

Remarks

In Suan Dusit Rajabhat University, the activities that require electricity take place during working hours, which are exactly in the peak hours. To find the

Copyright by Mahidol University

activities that could avoid that specific period of time requires careful consideration and entails the willingness of the people responsible for the activities.

Table 5.4 The improvement on the air-conditioning system

Title of implementation plan: 5.3.4 The improvement on the air-conditioning system				
Objective: To improve the efficiency of the university's air-conditioning system and to reduce the electricity usage				
Goal: To adjust the air-conditioning system in the University to ensure that it is suitable for that location				
Responsible person: Buildings division				
Number	Activity	Responsible person	Duration	Expected outcome
1.	To survey the current information of Suan Dusit Rajabhat University's air-conditioning system	Buildings division	6 months	The basic information on the air-conditions/brand/model/wattage used/life span
2.	To change the old air-conditioners that use up too much electricity to brand new ones that contain No.5 Electricity Saving logo.	Buildings division	6 months	To obtain brand new air-conditioners that save electricity

Copyright by Mahidol University

In reference to the framework, this implementation plan is a part of the improvement on the electricity usage pattern in the university. According to the survey and the observation from the second round of the discussion group participants, it is found that most of the air-conditioners that have been used excessively for far too long which also contain damages in some areas do not contain No. 5 Electricity saving logo.

Remarks

1. The main responsible person for this implementation plan is the buildings division, which has their handful on workload. If each division had a personnel who is knowledgeable on electrical appliances, it would be simple to record the data and the observations, also to summarize the report for their respective division.

2. The 6 months duration for the survey of the current data on the air-conditioning system is too long. This should be done within 1-3 months.

Copyright by Mahidol University

Table 5.5 The improvement on the light illumination

Title of implementation plan: 5.3.5 The improvement on the light illumination				
Objective: To improve the efficiency of illumination and to reduce the usage of electricity.				
Goal: Every building and the external of the building must have modern electric light bulbs that save electricity.				
Responsible person: Buildings division				
Number	Activity	Responsible person	Duration	Expected outcome
1.	To survey the number and the type of electric bulbs	Every division must report to the Buildings division	6 months	The data on the amount/ type/ wattage used by the electric light bulbs at the university
2.	To change the light bulbs used in street lamps to LED ones.	Buildings division	3 months	Electric light bulbs used in street lamps to LED ones.
3.	To change the light bulbs in the building to T5 bulbs along with the installation of light reflective lamp shade.	Buildings division	3 months	Electric bulbs to T5 bulbs along with the installation of light reflective lampshade.

In reference to the framework, this implementation plan resembles the 5.3.4 plan but it is a survey on the light bulbs.

Remarks

1. The light bulbs used in the University are mostly Fluorescent T8 bulbs and T12 fat bulbs. If the light bulbs had been replaced to thin T5 bulbs, the University would be able to save more electricity by 30 percent but the cost of installation is high.

Copyright by Mahidol University

The duration of break even would be 1.09 year per bulb (Department of Alternative Electricity and Efficiency)

2. The 6 months duration of the survey on light bulbs data is too long. This should be done within 1-3 months.

Table 5.6 The improvement on the efficiency of office automations

Title of implementation plan: 5.3.6 The improvement on the efficiency of office automations				
Objective: To survey and proceed with the improvement to change the office automation such as computers, printers etc.				
Goal: To transform the old appliances that use up too much electricity to new ones that save electricity.				
Responsible person: Buildings division and maintenance				
Number	Activity	Responsible person	Duration	Expected outcome
1.	To survey the amount of electrical appliances in the division.	Every division must report to the buildings division and maintenance	6 months	The data on the amount/ type/ wattage used by the electrical appliances at the university
2.	To change the broken electrical appliances or the old ones that use up too much electricity.	Buildings division and maintenance	6 months	Obtain new electrical appliances that save more electricity than the old worn out ones

Copyright by Mahidol University

In reference to the framework, this implementation plan resembles plans 5.3.4 and 5.3.5 but every division must compile all the data to deliver to the division of buildings and maintenance.

Remarks

1. This plan will succeed when every division participate in the survey seriously because if anything is omitted or the data is incomplete in every aspect, we would not be able to find out the true data of all the electrical appliances in the university. Therefore, as the main responsible person; the building division and maintenance must explain to the representatives from every division to make them understand to further ensure the correctness of the data as well as, to shorten the period of operation.

2. The 6 months period of survey on the data of electrical appliances is too long. This should be done within 1-3 months.

Table 5.7 To increase the efficiency of communication on the reduction of electricity usage

Title of implementation plan: 5.3.7 To increase the efficiency of communication on the reduction of electricity usage.				
Objective: To allow personnel and every students in the University to understand the plan to reduce the electricity usage at the University and must be able to follow correctly.				
Goal: Executives, professors, staffs and students				
Responsible person: electricity saving working group and public relations department				
Number	Activity	Responsible person	Duration	Expected outcome
1.	To make announcement via wire broadcasting.	Public relations department	Every week	Executives, professors, personnel and students
2.	Post advertisements	Public relations department	All year round	

Copyright by Mahidol University

Table 5.7 To increase the efficiency of communication on the reduction of electricity usage (cont.)

Title of implementation plan: 5.3.7 To increase the efficiency of communication on the reduction of electricity usage.				
Objective: To allow personnel and every students in the University to understand the plan to reduce the electricity usage at the University and must be able to follow correctly.				
Goal: Executives, professors, staffs and students				
Responsible person: electricity saving working group				
Number	Activity	Responsible person	Duration	Expected outcome
3.	To hold a seminar or a meeting to clarify the implementation plan to reduce electricity usage by pointing out the plan and the measures.	Electricity Working Group and the Public relations department	2 times a year	At the University to understand the implementation plan and other measures.

Remarks

1. The researcher feels that the announcement made over the wired broadcasting would not be heard in every location of the University for example, in the air-conditioning room or if heard; it would still be unable to comprehend because the message is long. Therefore, we should devise a new method to make short brief announcements over the wired broadcasting and it must stimulate the listeners' interests.

Copyright by Mahidol University

2. The posting of public relations advertisements

3. To hold a seminar on the reduction of electricity usage. Formerly, there was a need to ask for cooperation from various divisions to attend the seminars, which

had minimal effect. But, in terms of the students, there has never been an initiation to hold a seminar to educate them. Therefore, there must be an appropriate arrangement that would attract the students such as games or a competition for a prize.

Table 5.8 To hold a meeting to create a framework to reduce the electricity usage and to determine the goal of each division

Title of implementation plan: 5.3.8 To hold a meeting to create a framework to reduce the electricity usage and to determine the goal of each division.				
Objective: To provide each division in the University to have a framework and a goal to reduce the electricity usage in accordance with the context of each division.				
Goal: Every division				
Responsible person: electricity saving working group				
Number	Activity	Responsible person	Duration	Expected outcome
1.	To provide coaching on the creation of framework to the representatives from every division.	Electricity saving working group	1 month	This provides knowledge and understanding to every division on the framework creation in relations to the reduction of electricity usage
2.	To create a plan to reduce electricity usage for each division.	Every division	2-3 months	Obtain new plans and measures on the reduction of electricity usage for each division.

Copyright by Mahidol University

Remarks

1. In reference to the framework, this implementation plan concentrates on the capacity of each division in creating a plan on the reduction of electricity usage of their own. Each division in the University contains both similar and dissimilar contexts. To implement the implementation plan on the reduction of electricity usage, which is an overview of the entire university might not be suitable for every department. Participants of the discussion group have expressed an idea to create individual framework for each division.

2. Apart from providing the division to create a plan on their own, each division must specify an indicator and the standard to evaluate the result of the implementation plan of their own. But, there must be a central division to consider these indicators and standards inclusive of the evaluation.

Table 5.9 The "Watchful Eye project"

Title of implementation plan: 5.3.9 The "Watchful Eye project"				
Objective: To persuade the personnel and the students to cooperate in observing and reporting the defects on the use of electricity				
Goal: Personnel and students				
Responsible person: electricity saving working group				
Number	Activity	Responsible person	Duration	Expected outcome
1.	To publicize the format of the project and the objectives of this project through various channels such as wired broadcasting, exhibition, brochures distributing and posting of advertisements.	Electricity saving working group	1 month	To receive report at the working group on the cases of the misuse of electricity at the university

Copyright by Mahidol University

This “Watchful Eye project” derives from the Bangkok’s Magic Eye project. The participants from the discussion group have revised it to be suitable to the reduction of electricity usage at the university. From the observation of the participants in the discussion group, it was found that there is a frequent electricity leakage in the University. For example, leaving the door to the air-conditioning room open letting the cool air to come out of the building, students remain inside the air-conditioning room after classes.

Remarks

1. Allowing the volunteers to report any misuse of the electricity usage might not produce good effects because it is a volunteer work accompanied with the possibility that the executives, professors or even the staff might be the ones overusing the electricity causing the volunteers to not have courage to report or to consider that it is not useful to report it. Therefore, there must be a clarification to the volunteers.

2. The “Watchful Eye project,” determines that the participants taking part in the project observe as volunteers. The project must specify clear structure, which involves a third contact person, and there must be at least one leader for the volunteers to gather them and lead them. In the case where anyone quits, there must be a compilation of data to a responsible person to allow for the longevity of this volunteer project.

Table 5.10 To provide training on the reduction of electricity usage at the office

Title of implementation plan: 5.3.10 To provide training on the reduction of electricity usage at the office				
Objective: To help the personnel to understand the reduction of electricity usage				
Goal: Personnel from every division				
Responsible person: electricity saving working group				
Number	Activity	Responsible person	Duration	Expected outcome
1.	To provide training on the reduction of electricity usage at the office.	Electricity saving working group	Approximately 1 hour, depending on each division	To help the personnel to understand the reduction of electricity usage.

Copyright by Mahidol University

In reference to the framework, this implementation plan focuses instilling the knowledge and understanding on the reduction of electricity usage especially, the division that possesses the electrical automation that use an enormous amount of electricity such as home bakery, laboratory including various activities at Special Task Planning division.

Remarks

This plan still has a number of ambiguities such as whether the guest lecturer will be knowledgeable enough to discuss the topic of reduction of electricity usage in a particular affair. Therefore, we must focus on the division that does not involve specialized affair; that has regular type of work with no special equipment such as part of various divisions. And, there must be an appropriate guest lecturer, if there is going to be training on the personnel who work for specialized division, which involves high usage of electricity. Or the guest lecturer must have prior knowledge on the electrical equipment to ensure maximum usefulness.

Table 5.11 To provide training on the reduction of electricity usage in the classroom and the laboratory

Title of implementation plan: 5.3.11 To provide training on the reduction of electricity usage in the classroom and the laboratory.				
Objective: To educate the students with the knowledge of electricity saving				
Goal: Students from various faculties				
Responsible person: electricity saving working group				
Number	Activity	Responsible person	Duration	Expected outcome
1.	To coach representatives from the student body on the matter of reduction of electricity use.	Electricity saving working group in cooperation with various faculties	To hold one training in one academic year	To help the students to learn and understand the methods to reduce the use of electricity in the classroom and the laboratory.

Copyright by Mahidol University

In reference to the framework, this implementation plan emphasizes on the knowledge and understanding of reduction of electricity usage. The participants from the discussion group determine the pattern to be a training for the representatives from the student body. This plan intends to allow for the relay of knowledge from the representatives to the other students in the same year, which will lead to more cooperation in the reduction of electricity usage among the students.

Remarks

1. To attract the students, there must be an interesting format. If the training is done in a dull fashion or too academic, there would be no motivation for the representatives to be interested in the matter causing the plan to fail.

2. Training on the knowledge of reduction of electricity usage must be incorporated with the orientation activity to instill the consciousness on the reduction of electricity usage to the new students.

Table 5.12 To survey the opinions of people on the matter related to the reduction of electricity usage in the university

Title of implementation plan: 5.3.12 To survey the opinions of people on the matter related to the reduction of electricity usage in the university.				
Objective: To survey the opinions and satisfactions of the personnel and the students in the aspect of the reduction of electricity usage to improve the plan regularly.				
Goal: Personnel and students				
Responsible person: electricity saving working group				
Number	Activity	Responsible person	Duration	Expected outcome
1.	To survey opinions and satisfaction of the personnel and students on the reduction of electricity usage.	electricity saving working group and Dusit poll or research institution.	Every academic year	To be aware of the opinions that people have on electricity management done at the University from the students and the personnel to implement improvement.

Copyright by Mahidol University

In reference to the framework, this implementation plan wishes to find out the feedback on the reduction of electricity usage at the university. This is a good plan since it will inform the effects obtained from the operation on the reduction of electricity usage measure that the personnel and the students would regularly observe such as the turning off lights and computer screens during lunch.

Table 5.13 To hold a meeting to brainstorm ideas to determine or improve the policies, objectives and plans related to the reduction of electricity usage

Title of implementation plan: 5.3.13 To hold a meeting to brainstorm ideas to determine or improve the policies, objectives and plans related to the reduction of electricity usage.				
Objective: To minimize the weakness and obstacles of the policies related to electricity in the university. To modernize them and accomplish the goals expected.				
Goal: University executives and the Electricity working group				
Responsible person: electricity saving working group				
Number	Activity	Responsible person	Duration	Expected outcome
1.	To hold a meeting to brainstorm idea to consider the policies and goals related to the reduction of electricity usage.	electricity saving working group and Every division	In an interval of one fiscal year	To improve the policies, measures and implementation plans on the reduction of electricity usage to ensure that they are modernized.
2.	To hold a meeting to consider the improvement on the implementation plans to reduce the electricity usage.			

Copyright by Mahidol University

In reference to the framework, this implementation plan determines the improvement on the implementation plan to reduce the use off electricity which will have to be carried out every year to ensure that they are modernised.

Remarks

There must be serious consideration on the improvement of policies, goals and measures to reduce the usage of electricity and the brainstorm of ideas to improve policies so that they are suitable to the university. Formerly, there has been a meeting held every year but the policies have remained the same ones that have been obtained from the Ministry of Electricity 2011

5.4 Recommendations from the discussion group

In group discussions, useful recommendations on the reduction of electricity usage at the University. The discussion groups totally agreed that:

5.4.1 Policy-wise

There must be an adjustment to the University's electricity conservation policy to obtain suitability to the university's context. There must be policies to stimulate the cooperation among the students in reducing the electricity usage in the University. The executives must see the importance of cooperation in the reduction of electricity usage in the long term by involving the personnel, professors and students in the process of determining the policies, goals and measures in the reduction of electricity usage substantially. This should be able to be implemented seriously through benchmarking with other universities that have succeeded in reducing electricity usage.

5.4.2 Public relations-wise

Buildings division along with the public relations department must cooperate in broadcasting the message related to reduction of electricity use and the personnel in the University must be aware of electricity saving. There must be broadcasting and the campaign avocation through various channels regularly to allow the personnel to see and be aware of the importance of electricity and the reduction of

Copyright by Mahidol University

electricity usage to promote the cooperation among the personnel to save electricity seriously. Also, there must be the foster of electricity reduction behavior to encourage lifelong corporate culture.

5.4.3 Initiation of knowledge training activities

There must be training on the knowledge related to the methods on the use of various types of electrical equipment in the right way and the campaign must be organized for each working in the University to compete in the reduction of electricity usage to stimulate the personnel to be aware of their own situation on electricity usage and to raise consciousness on the cooperation to reduce the use of electricity in the University in the future.

5.4.4 Air-conditioners, lighting system and the air ventilation system within the building

5.4.4.1 Air-conditioning system

Most of the air-conditioners in the University are outdated and have been overused past the lifetime making them consume a lot of electricity. Furthermore, the efficiency of the air-conditioners does not correspond with the size of the room leading the waste of electricity. By installing separate parts of the air-conditioners, the hot coils would collide causing the air-conditioners to be overworked because the hot air are emitted towards each other.

Checking and maintaining the conditions of the equipment according to their lifetime help to save electricity since saving electricity requires different components such as behaviors, consciousness and the use of equipment that are able to save electricity. Therefore, the University has set one of its goals to improve the entire air-conditioning system. But, there is a limitation on the budget, which is high. The basic action that can initially be taken is to maintain their conditions such as cleaning them as per the schedule also helps to reduce the cost of electricity.

Copyright by Mahidol University

5.4.4.2 Lighting system

Most of the light bulbs used in the University are the fluorescent ones with T12 size or the fat bulbs. There are a few thin T5 bulbs installed

by the Electricity Generating Authority of Thailand. Therefore, it is wise to invest on the installation of thin T5 bulbs in every building and passageway all over the campus.

5.4.4.3 Air ventilation system in the building

Most of the buildings in the University are opaque. Some of the rooms do not have windows to allow for air ventilation leading to a constant need to use air-conditioners. The buildings are located closely to each other, which block the natural wind. Therefore, there must be an analysis on the air ventilation before the new buildings are constructed.

Copyright by Mahidol University

CHAPTER VI
CONCLUSION, DISCUSSION AND RECOMMENDATIONS

A research on participatory implementation plan in electricity reduction of Suan Dusit Rajabhat University has risen from the project to reduce the use of electricity in the government sector which stipulated that must reduce the expense on electricity by 10 percent in comparison to the previous year. Furthermore, the University still lacks solid measures in accordance to the reduction of electricity usage policies and the cooperation among the personnel the University to formulate the implementation plan to reduce the use of electricity has been found to be deficient. The details can be elaborated below:

6.1 Electricity usage

Suan Dusit Rajabhat University has limited space but is housing many academic buildings and other buildings, which results in overcrowding that further leads to poor air ventilation within the university. Most of the buildings are dense and use air-conditioners excessively during work hours. Most of the air-conditioners have been in used past their lifetime and do not contain No.5 electricity saving logo. In terms of the electric bulbs, most of them are fluorescent with the sizes such as T12 and T8 and there are about 10 percent of thin T5 bulbs in use.

6.2 The change that affects electricity management

The government's project to reduce electricity usage in the government sector has majorly stimulated the University to promote the reduction of electricity usage because having the expenses on electricity use getting higher every year is damaging the university. Also, this would result in the country having to import electricity to supply to the increasing demand.

Copyright by Mahidol University

The University has announced the policy to reduce electricity use in 2011 which alerted the people to reduce the use of electricity to some extent. But, the attempt is still inadequate to aim to achieve the 10 percent decrease in electricity usage in comparison to the previous year. Furthermore, the measures established mostly covered the promotion to save electricity which lacks other dimensions such as the reduction of electricity use such as the improvement on electrical appliances, the development on electricity saving system for example the human movement detection sensor. This further includes the consideration to find alternative source of electricity and other related issues regarding the university's 6 policies on the reduction of electricity usage.

6.3 Formulation of a participatory implementation plan on the reduction of electricity usage

The idea to manage the use of electricity at the University has taken shape when the University announced the policies to reduce electricity usage by adhering to the Department of Alternative Electricity Development and Efficiency published by the Ministry of Electricity in 2011. This has resulted in a decrease on the electricity expense but still the 10 percent decrease in the reduction of electricity use in comparison to the previous year has not been achieved according to the government's project to reduce the use of electricity in the government sector. Therefore, there must be provisions to revise the policies and the measures inclusive of the pathway to success.

In reference to the research it was found that the factors to reduce the use of electricity at the University efficiently are:

1. The improvement on the system and the electrical appliances such as the air-conditioners, lighting system, office automation to keep them well maintained as per the standard prescribed by the Ministry of Electricity (Contain No. 5 electricity saving logo).

Copyright by Mahidol University

2. To participate in the reduction of electricity usage

From the study of behavioral use of electricity in the personnel and the students, it was found that the personnel and professors possess moderate to

high level behavior in saving electricity. While the students posess moderate to low level of behavior in saving electricity. This shows that the students still lack knowledge and understanding on the reduction of electricity usage. And, there must be a participatory method to establish knowledge and understanding.

Apart from this, participatory process must include the determination of policy, goals, measures and the formulation of an implementation plan to reduce electricity usage. From the second discussion group, it is found that every working in the University has sent their representatives to participate in the discussion resulting in a pleasant atmosphere. There has been an expression of opinions including the criticisms on the strengths and weaknesses.

6.4 Result discussion

6.4.1 Current situation on the reduction of electricity usage

From what the researcher has studied on the use of electricity at the University, there are objectives to allow the information gathered to supplement the decision making process for the Electricity working group as well as the executives to be informed of the present situation in every aspect of electricity use at the University in the first discussion group to determine the policies and goals to reduce the electricity usage. Using the basic information of the University to supplement the decision making process in problem resolution is consistent with the study carried out by Therdphan Saowapakmetheekul (2012) who has developed the implementation plan to establish the participatory regional well-being of the community. The researcher has analyzed the contextual information to supplement the formulation of plan on community well-being. The discussion group has found that the participants are eager in expressing their opinions and exchanging their experiences with determination. All of them have taken parts in every activity, which is consistent with the study carried out by Songsuda Traipakornkusol (2002), which studied the adaptation of concept to be used to solve the issues found on community health. It has been found that the concept of participatory action in resolving health of the community has stimulated the population to be more attentive in discussion,

Copyright by Mahidol University

expressing of ideas on community problems. There are planning and practice in resolving the problem together.

6.4.2 Information on the electricity saving behavior.

For the news information dissemination on the reduction of electricity usage channels, the experiment group requested for the information dissemination to be done through various medium such as notice boards, posters, campaign organization or online media even the announcement through wired broadcasting within the university. The experiment group has explained that if it is possible to inform the audience about the correct messages on electricity usage reduction, it could lead to the people following the right principles. And, the news information received is one of the most important factors that is used to supplement the decision making process on any action. This is consistent with the research carried out by Kanchana Sornkaewdara (2003) and Jullada Chaihuadcharoen (1993), which studied the factors that have influence on electricity saving behavior in the household by housewives. It has shown that the information recognition on the reduction of electricity usage was a stimulant the electricity saving behavior.

6.4.3 Measure and implementation plan on the reduction of electricity usage

For measure and implementation plan to improve the air-conditioning system, this stipulates the installation of old air-conditioners that use up a lot of electricity to new modernized ones that contain No.5 electricity saving logos being consistent with the 53 methods to save electricity determined by Thailand Environment Institute Foundation.

For measure and framework on the improvement of light illumination, this specifies that there should be an installation of light bulbs in the buildings to T5 light bulbs along with the light reflective shades. This is consistent with the 53 methods to save electricity determined by Thailand Environment Institute Foundation, which states that the lamps that are used in the rooms should have reflective sheets to enable the even distribution of lights from the light bulbs.

Copyright by Mahidol University

6.5 Recommendations

6.5.1 Recommendations from the research

1. From the participatory implementation plan on the reduction of electricity usage at Suan Dusit Rajabhat University, the researcher has proposed a guideline to formulate the implementation plan but it still lacks the implementation plan evaluation tracking system. If there is a proper evaluation tracking system incorporated, the execution of the plan would be a success and it would quicken the time it takes to achieve the goals.

2. The Electricity Working Group at the University must place more importance on the improvement of the reduction of electricity usage because this policy received from the Ministry of Electricity is only a wide scope. And, there must be further interpretation on the actual meaning. Yet, there is still an issue on why the establishments of measures that are in accordance with the policies are incomprehensible. And, this results in an inconsistency and the lack of support from the university's existing policies.

3. The participants in the discussion group must be knowledgeable and must understand the reduction of electricity usage. There might be a case in which the representatives from various divisions not having adequate knowledge on the matter because the representatives might not possess sufficient knowledge on electricity use in their respective divisions.

4. There should be an observation on the electrical equipment, types of buildings and detailed usage as per the principles prescribed by the engineers. This would enable us to evaluate if there should be an improvement or alteration on the electrical equipment. Where would be most useful?

6.5.2 Recommendations for future research

1. There should be a study on corporate culture or permanency by brainstorming ideas from personnel within the organization such as the brainstorm of opinions in establishing the culture to save electricity.

Copyright by Mahidol University

2. There should be a study on alternative electricity in various forms that deem suitable to the organization such as solar electricity and wind power by studying the worthiness in investment and the payback period.

3. There should be a study on the efficiency of electrical equipment both on the air-conditioning system and the light illumination system by emphasizing on the comparison of value investment and payback period.

Copyright by Mahidol University

BIBLIOGRAGHY

IN ENGLISH

Allen, Lonis A. (1982) . Making Managerial Planning More Affective. Chicago. Donnele & Sone Company.

Green, L.W. et.al. (1980). Health Education Planning: A Diagnostic Approach, Mountain View. Mayfield Publishing Company.

Keith D. (1981). Human Behavior. 6th ed. New York. McGraw – Hill.

Krejcie, Robert V. and Earyle W. Morgan. (1970) . Educational and Psychological Measurement. N.P.

Midgley, J., Hall, A., Hardiman, M., & Narine, D. (1986). Community participation Social development and the state. New York. Methuen.

Pickett, G. and Hanlon, J. (1990). Public Heath: administration and practice. Maryland Heights. Times Mirror/Mosby College Publishing .

United Nations. (1978). Popular Participation in Decision Making for Development. New York. United Nations Publication.

Uphoff,T.N. (1977). The Political Economy of Devalopment : Theoretical and Empirical Contributions. Berkley. The University of California Press.

IN THAI

Anant Katewong. (1998). Planning Principle and Technique. Faculty of Political Science. Thammasart University. Bangkok. Thammasart University Press.

Arkhom Jansuntorn. (1986). School Supervision. LopBuri. Regional Education Office No. 3.

Boonman Waricha. (2006). Participatory development planning of Had ASA Subdistrict Administrative Organization Sappaya Distric Chainat Province. Graduate School. Nakhonsawan. Nakhonsawan Rajabhat University.

Butrbamrung Thammachote. (1999). Energy efficiency in commercial buildings: a case study Phaholyothin Building Kasikornthai Bank. M.ENG. Thesis.

Copyright by Mahidol University

Faculty of Engineering. Bangkok. King Mongkut's Institutes of Technology North Bangkok.

Chanchai Arjinsamaja. (1984). Education management. Bangkok. National Office of Buddhism Publishing.

Dilok Boonruengrod. (1994). The Academy's Educational Planning. Bangkok. Faculty of Education. Suan Sunandha teacher's collage.

Electricity Generating Authority of Thailand. (1994). Electricity. Bangkok . Electricity Generating Authority of Thailand.

Energy Conservation Promotion Fund. (1998). 108 Energy Saving Solutions. Energy Policy and Planning Office.

Jaruay Boonyubon. (1992). 49 Technique in Electricity. Bangkok. Se-education Publishing.

Jermsak Pinthong. (1983). To mobilize people for rural development in the management of rural development: The education for Thai society development. Bangkok. Chulalongkorn University Press.

Jirapol Sinthunava. (1994) . Environmental Quality by reducing electricity usage. Mimeographed.

Jullada Chaihuadcharoen. (1993). Factors Influencing Bangkok Housewives Energy Saving Behavior. M.E. Thesis. Faculty of graduate studies. Nakhon Patom. Mahidol University.

Jureephan Hamkhampai. (2001). Performances of the annual operational planning. In Primary Education Office, district / sub-district. Under the Office of Primary Education of Mahasarakham. M.E. Thasis. Mahasarakham. Graduate School. Mahasarakham University.

Kanchana Sornkaewdara. (2003). Energy Saving Behaviors Of Personnel In Mahidol University At Salaya Campus Stipulated By The government For Energy Conservation. M.E Thesis. Faculty Of Graduate Studies. Nakhon Patom. Mahidol University.

Kannika Chomdee. (2001). The participation of the people that affect economic development Case study at Sarapee Project Dahn Chang Sub-district Varinchamrab District Ubonratchathani Province. M.PA Independent Study. Graduate School. Mahasarakham. Mahasarakham University.

Copyright by Mahidol University

Matsuo Motoki. (2000). Energy saving techniques in the industry. Bangkok. Technology Promotion Association(Thailand – Japan). TPA. Publishing.

Nirand Jongwutthiwate. (1984). The strategy to strengthen the participation of citizens in rural development. Bangkok. Saksopha Publishing.

Nirat Eimami. (1997). Planning Technique in Health Education and Public Health. Bangkok. Express Transportation Organization of Thailand.

Ouaychai Janpanyasil. (1985).Plan and Planning. Bangkok. Thammasart University.

Pairat Techarin. (1984). Policies and strategies of community participation in the development strategy today. The participation of citizens in development. Bangkok. Saksopha Publishing.

Piyathida Treedet. (1998). Financial Planning of The Government's Hospital : Theory and Practice. Bangkok. Faculty of Public Health. Mahidol University.

Pongsan Suwannachot. (1994). The Energy Conservative Design for An office Building in Bangkok Case Study:Simulator Hall & Office Building Of Thai International Airways. M.Arch. Thesis. Graduate School. Bangkok. King Mongkut Institute of Technology Ladkrabang.

Prachum Rodprasert. (1985). Principle and Theory of Policy and Planning. Bangkok. Netikul Publishing.

Public Health Bureau of Policy and Strategy. (2000). Words and Meaning in Public Health Policy and Planning. Bangkok. N.P.

Regional Health Division of The office of Permanent Secretary. (1999). A Managing Guide of Sanatorium. Bangkok. Agricultural cooperative printing demonstrations of Thailand Ltd.

Sananjit Sukondthasub. (1981). The series of teaching documents of the School Planning for Development 1-7 Unit. Bangkok . Sukhothai Thammathirat University.

Sasivimon Palasri. (1995) A Study of Media Exposure, Knowledge, Attitude and Practice Regarding Economic Consumption of Electric Power of Officials and Staff in Public and Private Sectors and State Enterprise in the Bangkok Metropolitant Area. M.A. Thesis. Graduate School. Bangkok. Chulalongkorn University.

Copyright by Mahidol University

Sippanond Ketthut. (1985). Education Reform. Bangkok. Thai wattana panit Publishing.

Somkid Bangmo. (1999). Organization and Management. Bangkok. June Publishing.

Somwang Pitiyanuwat. (1997). Educational Evaluation. Faculty of Education. Chulalongkorn University Press.

Songsuda Tripakornkuson. (2002). The concept of participation applied in community health issues. Khon Kean. Khon Kean University.

The Office of Environmental Policy and Planning. (2000). Environmental Quality Situation Report of 1999. Bangkok. P-Printing group company.

The office of National Energy Policy Council. (2002). Thailand's commercial energy needs in the first quarter of 2002. Bangkok. Ministry Of Energy.

Therdphan Saowapakmeteekul. (2012). The Development of Local Participation for Health Promotion Operation Plan By Strategic Route Map Process In Chakkarat Sub-District Chakkarat District Nakhon Ratchasima Province. MPH. Thesis. Graduate School. Mahasarakham. Mahasarakham University.

Thongchai Santiwang. (1996). Customer Behaviors. Bangkok. Thammasart University Press.

Thonglor Detthai. (1997). General Public Health Management. Bangkok. Sukhothai Thammathirat University.

Thirawut Senakham. (1998). From Individual To Public : Process to Community Strengthen. Bangkok. Local Development Institute.

Totsapon Krityapisit. (1994). Participatory of Village Chief and Headman toward Project of development by “Bavorn” and “Barom” Processes for Golden land Nongchok. MSW. Thesis. Faculty of Social Welfare. Bangkok. Thammasart University.

Waraporn Laohachakul. (2001). Methods and Components of Operational Plan Performing Among Public Health Personnel at Sub-district Level in Rayong Province. M.PH. Thesis. Graduation School. Chaing Mai. Chaing Mai University.

Copyright by Mahidol University

Uthai Boonprasert . (1989). Education Planing. Bangkok. Chulalongkorn University Press.

APPENDICES

Copyright by Mahidol University

APPENDIX A

SURVEY FORMS OF ELECTRICITY BULB AIR-CONDITIONER

แบบสำรวจจำนวนและชนิดของหลอดไฟฟ้า

ตารางแบบสำรวจจำนวนและชนิดของหลอดไฟฟ้าในมหาวิทยาลัยราชภัฏสวนดุสิต

อาคาร	ชั้น	ห้อง	หลอดไฟ						บัลลาสต์	
			ชนิด	ขนาด(W)	ชนิดโคม	หลอด/โคม	จำนวน (โคม)	ลักษณะ การติดตั้ง	ชนิด	Power(W)

Copyright by Mahidol University

แบบสำรวจจำนวนและชนิดของเครื่องปรับอากาศ

ตารางแบบสำรวจจำนวนและชนิดของเครื่องปรับอากาศในมหาวิทยาลัยราชภัฏสวนดุสิต

อาคาร	ชั้น	ห้อง	ชื่อห้อง	ชื่อผลิตภัณฑ์	ชนิด	ขนาดBTU/hr	อายุ (ปี)	ฉลากประหยัดไฟ	ชนิดเทอร์โมสตัท	กำลังไฟ Volt(V)

Copyright by Mahidol University

APPENDIX B
QUESTION GUIDELINES
FOR FOCUS GROUP DISCUSSION

เครื่องมือฉบับที่ 3 : ประเด็นสนทนากลุ่ม
ครั้งที่ 1 : คณะทำงานด้านการจัดการพลังงานของมหาวิทยาลัยราชภัฏสวนดุสิต

A – บรรยายข้อมูลสถานการณ์ปัจจุบันของการใช้ไฟฟ้าของมหาวิทยาลัยราชภัฏสวนดุสิตที่ได้จากการศึกษาเอกสารและข้อมูลจากการสำรวจหลอดไฟฟ้า และเครื่องปรับอากาศ เพื่อชี้ให้เห็นถึงสภาพปัจจุบันของการใช้ไฟฟ้าในมหาวิทยาลัยราชภัฏสวนดุสิต

B – บรรยายนโยบายด้านการลดการใช้พลังงานที่มีอยู่ 6 ข้อของมหาวิทยาลัยราชภัฏสวนดุสิต

ประเด็นสนทนา :

1. จากนโยบายด้านพลังงาน ของมหาวิทยาลัยราชภัฏสวนดุสิต ที่มีอยู่ 6 ข้อ ดังนี้

1. พัฒนาระบบการจัดการพลังงานอย่างเหมาะสม สอดคล้องกับกฎหมายและข้อกำหนดอื่น ๆ ที่เกี่ยวข้อง

2. ปรับปรุงประสิทธิภาพการใช้ทรัพยากรพลังงานขององค์กรอย่างต่อเนื่องและเหมาะสมกับการทำงาน

3. กำหนดแผนและเป้าหมายการอนุรักษ์พลังงานในแต่ละปี และสื่อสารให้บุคลากรทุกคนเข้าใจและปฏิบัติได้อย่างถูกต้อง

4. การอนุรักษ์พลังงาน เป็นหน้าที่ความรับผิดชอบของผู้บริหารทุกระดับ และบุคลากรทุกคนที่จะให้ความร่วมมือในการปฏิบัติตามมาตรการที่กำหนด ติดตามตรวจสอบ และรายงานต่อคณะทำงานด้านพลังงาน

5. สนับสนุนทรัพยากรด้านบุคลากร ด้านงบประมาณ เวลาในการทำงาน การฝึกอบรม และการมีส่วนร่วมในการยำเสนอ ข้อคิดเห็นเพื่อพัฒนางานด้านพลังงาน

6. ผู้บริหารและคณะทำงานด้านพลังงานทบทวน และปรับปรุงนโยบาย เป้าหมายและแผนการดำเนินการด้านพลังงานทุกปี

Copyright by Mahidol University

7. จากการดำเนินการตามนโยบายด้านพลังงาน ของ มหาวิทยาลัยราชภัฏสวนดุสิตที่ผ่านมา

1.1 ท่านคิดว่าการลดการใช้พลังงานไฟฟ้าประสบความสำเร็จหรือไม่

1.2 ข้อจำกัดของมหาวิทยาลัยเรื่องการลดการใช้พลังงานคืออะไร

1.3 นโยบายแต่ละข้อจุดเด่น – จุดด้อย และข้อควรปรับปรุง ในเรื่องใดบ้าง

1.4 นโยบายเพิ่มเติม ที่เหมาะสมกับสภาพของมหาวิทยาลัยราชภัฏสวนดุสิต

1.5 คณะทำงานควรกำหนดเป้าหมายในการลดการใช้พลังงานไฟฟ้า ของมหาวิทยาลัยในด้านต่าง ๆ

- จำนวนหน่วยไฟฟ้าลดลงกี่เปอร์เซ็นต์
- จำนวนค่าใช้จ่ายที่ลดลงเท่าไหร่
- พฤติกรรมผู้ใช้พลังงานเปลี่ยนในระดับใด
- การเปลี่ยนอุปกรณ์ให้ได้มาตรฐานทุกกี่ปี จำนวนเท่าไหร่

1.6 จากนโยบายและเป้าหมาย ปัจจัยหรือวิธีการใดบ้างที่สามารถทำให้การจัดการพลังงานไฟฟ้าของมหาวิทยาลัยราชภัฏสวนดุสิตเกิดความยั่งยืน

1.7 มหาวิทยาลัยฯ ควรสร้างวัฒนธรรมองค์กรในการลดการใช้พลังงานไฟฟ้าอย่างไร

Copyright by Mahidol University

เครื่องมือฉบับที่ 4 : ประเด็นสนทนากลุ่ม

ครั้งที่ 2 : คณะทำงานด้านการจัดการพลังงานระดับหน่วยงาน ของมหาวิทยาลัยราชภัฏสวนดุสิต

A – บรรยายข้อมูลสถานการณ์ปัจจุบันของการใช้ไฟฟ้าของมหาวิทยาลัยราชภัฏสวนดุสิตที่ได้จากการศึกษาเอกสารและข้อมูลจากการสำรวจหลอดไฟฟ้า และเครื่องปรับอากาศ เพื่อชี้ให้เห็นถึงสภาพปัจจุบันของการใช้ไฟฟ้าในมหาวิทยาลัยราชภัฏสวนดุสิต

B – บรรยายนโยบายและเป้าหมายด้านการลดการใช้พลังงานของมหาวิทยาลัยราชภัฏสวนดุสิต ที่ได้จากการสนทนากลุ่ม ครั้งที่ 1.

ประเด็นสนทนา :

1.จากนโยบายและเป้าหมายด้านการลดการใช้พลังงาน ของมหาวิทยาลัยราชภัฏสวนดุสิต ท่านเห็นว่า ควรกำหนดเป็นมาตรการลดการใช้ไฟฟ้าอะไรบ้าง (ยกตัวอย่างให้ผู้เข้าร่วมสนทนากลุ่มดู) เช่น

มาตรการลดการใช้พลังงานไฟฟ้า

ก ระบบปรับอากาศ

1. ลดชั่วโมงการทำงานของเครื่องปรับอากาศ ในแต่ละวันโดยกำหนดเวลาตามความเหมาะสม เช่น เปิด-ปิด เวลา 08:30-12:00 น.และ13:00-16:30 น.

2. นอกเวลาราชการไม่ควรเปิดเครื่องปรับอากาศ เว้นแต่หน่วยงานที่มีภาระงานปกติในวันหยุดราชการ

3. เปิดเครื่องปรับอากาศในห้องประชุมก่อนการประชุม 15 นาที และปิดเครื่องปรับอากาศทันทีที่เลิกประชุม ไม่ใช้เครื่องปรับอากาศในวันหยุด ราชการและวันหยุดนักขัตฤกษ์ ฯลฯ

ข ระบบแสงสว่าง

1. เปิดไฟฟ้าแสงสว่างในห้องทำงาน เฉพาะเท่าที่ปฏิบัติงานอยู่ ปิดไฟฟ้าแสงสว่างที่ไม่จำเป็นในการใช้งาน

2. ปิดไฟฟ้าแสงสว่างระหว่างหยุดพักกลางวัน ในเวลา 12:00 น. - 13:00 น.หรือเมื่อเลิกใช้งาน ยกเว้นสำหรับผู้ปฏิบัติงานในเวลาหยุดพักกลางวัน ให้เปิดเฉพาะที่จำเป็น

3. ถอดหลอดไฟในบริเวณที่มีแสงสว่างมากเกินความจำเป็น หรือพิจารณาใช้แสงธรรมชาติจากภายนอก

Copyright by Mahidol University

2. แต่ละมาตรการควรจัดทำเป็นแผนปฏิบัติการอย่างไร (ยกตัวอย่างให้ผู้เข้าร่วมสนทนากลุ่มดู)

ตาราง(ตัวอย่าง) แผนปฏิบัติการลดการใช้พลังงานไฟฟ้า

ชื่อแผนงาน : ประชุมจัดทำแผนงานลดการใช้ไฟฟ้าและกำหนดเป้าหมายของแต่ละหน่วยงาน					
วัตถุประสงค์ : เพื่อให้แต่ละหน่วยงานในมหาวิทยาลัยได้มีแผนงานและเป้าหมายที่จะลดการใช้ไฟฟ้าตามบริบทของแต่ละหน่วยงานเอง					
เป้าหมาย : ทุกหน่วยงานมีแผนงานและเป้าหมายของตนเอง					
ผู้รับผิดชอบหลัก : สำนักงานอธิการบดี					
ลำดับที่	**กิจกรรม**	**ผู้รับผิดชอบ**	**ระยะเวลา**	**งบประมาณ**	**ผลที่คาดว่าจะได้รับ**
1.	ประชุมวางแผนลดการใช้ไฟฟ้าในหน่วยงาน	สวนดุสิตโพล (นายนิพนธ์ ทักษิณ)	1-7 เม.ย. 57	500 บาท (ตั้งประมาณการ)	1. เป้าหมายของสวนดุสิตโพลในการลดการใช้ไฟฟ้า 2. มาตรการลดการใช้ไฟฟ้าของสวนดุสิตโพล 3. เล่มรายงานต่อผู้รับผิดชอบหลัก (สำนักงานอธิการบดี)

Copyright© by Mahidol University

APPENDIX C
FORMS OF QUESTIONAIRE FOR PROFESSORS, STAFF AND STUDENT

เครื่องมือฉบับที่ 5

แบบสอบถาม

พฤติกรรมการประหยัดพลังงานไฟฟ้า ของอาจารย์ เจ้าหน้าที่ และนักศึกษา

ของมหาวิทยาลัยราชภัฏสวนดุสิต

คำชี้แจง

แบบสอบถามนี้เป็นส่วนหนึ่งของการเก็บข้อมูลประกอบการทำวิทยานิพนธ์ ของนักศึกษาปริญญาโท คณะสิ่งแวดล้อมและทรัพยากรศาสตร์ สาขาเทคโนโลยีการบริหารสิ่งแวดล้อม ภาคพิเศษ มหาวิทยาลัยมหิดล และเป็นข้อมูลเบื้องต้นเพื่อจัดทำแผนปฏิบัติการลดการใช้พลังงานไฟฟ้าแบบมีส่วนร่วม ของ มหาวิทยาลัยราชภัฏสวนดุสิต

กรุณาตอบแบบสอบถามตามความเป็นจริง หรือตามความคิดเห็นของท่าน ข้อมูลทั้งหมดจะใช้เพื่องานวิจัยในครั้งนี้เท่านั้น

แบบสอบถามแบบออกเป็น 5 ตอน ดังนี้

ตอนที่ 1 ข้อมูลพื้นฐานของผู้ตอบแบบสอบถาม

ตอนที่ 2 ข้อคำถามเกี่ยวกับการรับรู้ข้อมูลข่าวสารด้านการประหยัดพลังงาน

ตอนที่ 3 ข้อคำถามเกี่ยวกับพฤติกรรมการประหยัดพลังงานไฟฟ้า

ตอนที่ 4 สอบถามความคิดเห็นและข้อเสนอแนะเพิ่มเติม

โปรดอ่านและพิจารณาข้อความ แล้วทำเครื่องหมาย ✓ ในช่องที่ตรงกับระดับความคิดเห็นของท่านมากที่สุด

นายนิพนธ์ ทักษิณ

นักศึกษาปริญญาโท คณะสิ่งแวดล้อมและทรัพยากรศาสตร์

สาขาเทคโนโลยีการจัดการสิ่งแวดล้อม

มหาวิทยาลัยมหิดล

Copyright by Mahidol University

แบบสอบถาม

พฤติกรรมการประหยัดพลังงานไฟฟ้า ของอาจารย์ เจ้าหน้าที่ และนักศึกษา

ของมหาวิทยาลัยราชภัฏสวนดุสิต

ตอนที่ 1 ข้อมูลพื้นฐานของผู้ตอบ

สถานะภาพ ☐ อาจารย์ ☐ เจ้าหน้าที่ ☐ นักศึกษา

ตอนที่ 2 ข้อคำถามเกี่ยวกับการรับรู้ข้อมูลข่าวสารด้านการประหยัดพลังงาน

1. ท่านเคยรับรู้ข้อมูลข่าวสารด้านการประหยัดพลังงานหรือไม่ (ตอบได้มากกว่า 1 คำตอบ)

☐ ไม่เคย

☐ เคย **จากแหล่งใด** ◯ โทรทัศน์ ◯ หนังสือพิมพ์ ◯ วิทยุ ◯ แผ่นพับ/ใบปลิว
◯ อินเทอร์เน็ต ◯ การบอกต่อ ◯ อื่นๆ (ระบุ) .....

2. ท่านเคยรับรู้ข้อมูลข่าวสารเกี่ยวกับนโยบายของรัฐเกี่ยวกับการจัดการด้านการใช้พลังงานหรือไม่ (ตอบได้มากกว่า 1 คำตอบ)

☐ ไม่เคย

☐ เคย **จากแหล่งใด** ◯ โทรทัศน์ ◯ หนังสือพิมพ์ ◯ วิทยุ ◯ แผ่นพับ/ใบปลิว
◯ อินเทอร์เน็ต ◯ การบอกต่อ ◯ ที่ทำงาน ◯ การอบรม/ประชุม/สัมมนา
◯ อื่นๆ (ระบุ) .....

3. ท่านเคยรับรู้ข้อมูลข่าวสารการประหยัดพลังงาน ของ มหาวิทยาลัยราชภัฏสวนดุสิต หรือไม่ (ตอบได้มากกว่า 1 คำตอบ)

☐ ไม่เคย

☐ เคย **จากแหล่งใด** ◯ ป้ายประกาศ ◯ โปสเตอร์ ◯ แผ่นพับ/ใบปลิว ◯ การประชาสัมพันธ์
◯ E-mail ◯ กิจกรรม ◯ การบอกต่อ ◯ หนังสือราชการ
◯ การประชุม ◯ อื่นๆ (ระบุ) .....

4. ท่านต้องการให้มีการเผยแพร่ข้อมูลข่าวสาร ความรู้หรือกิจกรรมด้านการประหยัดพลังงานไฟฟ้าของมหาวิทยาลัยราชภัฏสวนดุสิต หรือไม่ อย่างไร (ตอบได้มากกว่า 1 คำตอบ)

☐ ไม่ต้องการ เพราะ .....

☐ ต้องการ เพราะ .....

โดยวิธี ◯ ติดป้ายประกาศ ◯ ติดโปสเตอร์ ◯ แจกแผ่นพับ/ใบปลิว
◯ จัดกิจกรรม ◯ หนังสือราชการ ◯ การประชาสัมพันธ์เสียงตามสาย
◯ การประชุม ◯ E-mail ◯ การบอกต่อ
◯ สื่อสังคมออนไลน์ เช่น Facebook , Line , WhatApp ฯลฯ
◯ อื่นๆ (ระบุ) .....

Copyright by Mahidol University

ตอนที่ 3 ข้อคำถามเกี่ยวกับพฤติกรรมการประหยัดพลังงานไฟฟ้า

ประเด็น การประหยัดพลังงาน	ลักษณะการปฏิบัติ		
	ทำทุกครั้ง	ทำเป็นบางครั้ง	ไม่เคยทำเลย
1. หน่วยงานของท่านปิดไฟฟ้าในช่วงพักกลางวัน			
2. ท่านปิดสวิตซ์ไฟ และเครื่องใช้ไฟฟ้าทุกครั้งที่เลิกใช้งาน			
3. หน่วยงานของท่านตั้งอุณหภูมิเครื่องปรับอากาศไว้ที่ 25-26 องศาเซลเซียส			
4. หน่วยงานของท่านกำหนดเวลาเปิดเครื่องปรับอากาศในช่วงเช้า 9.00 -12.00 น. และช่วงบ่าย 13.00 – 16.30 น.			
5. ท่านปิดสวิตซ์ไฟ และเครื่องใช้ไฟฟ้าทุกครั้งหลังเลิกใช้งานหรือหลังเลิกเรียน			
6. ท่านจะใช้บันได้แทนการใช้ลิฟต์ เมื่อขึ้น-ลงเพียงชั้นเดียว			
7. ท่านจะปิดเครื่องคอมพิวเตอร์ เครื่องพิมพ์ เสมอเมื่อไม่มีการใช้งาน			
8. ท่านตรวจทานข้อความที่จะพิมพ์บนจอภาพให้ถูกต้องก่อนที่จะสั่งพิมพ์			
9. ท่านจะไม่เสียบปลั๊กเครื่องใช้ไฟฟ้าทิ้งไว้ตลอด			
10. ท่านปิดตู้เย็นให้สนิททุกครั้งหลังงานการใช้งาน			
11. ท่านไม่นำของร้อนเข้าแช่ในตู้เย็นทันที			
12. ท่านพยายามใช้แสงสว่างจากธรรมชาติให้มากที่สุด			
13. ท่านปิดประตูทุกครั้งที่เข้าหรือออกจากห้องที่เปิดเครื่องปรับอากาศอยู่			
14. ท่านจะไม่สวมเสื้อผ้าหนาและมากชิ้น ในห้องที่เปิดเครื่องปรับอากาศ เพราะต้องใช้พลังงานทำความเย็นมากขึ้น			
15. ท่านใช้การส่ง E-mail แทนการส่งด้วยเอกสาร			
16. ท่านตั้งโปรแกรมให้คอมพิวเตอร์ปิดหน้าจออัตโนมัติ ถ้าไม่ใช้งานเกิน 15 นาที			

Copyright by Mahidol University

ตอนที่ 4 สอบถามความคิดเห็นและข้อเสนอแนะเพิ่มเติม

1. มหาวิทยาลัยราชภัฏสวนดุสิต ควรจัดกิจกรรมอะไร ลักษณะอย่างไร ในการลดการใช้พลังงานไฟฟ้า

.....

.....

.....

.....

2. ท่านคิดว่าอะไรคือปัญหาหรืออุปสรรคในการประหยัดพลังงานไฟฟ้าของมหาวิทยาลัยราชภัฏสวนดุสิต

.....

.....

.....

.....

3. ข้อเสนอแนะเพิ่มเติมต่อการนำแผนปฏิบัติการลดการใช้พลังงานไฟฟ้า ของ มหาวิทยาลัยราชภัฏสวนดุสิตไปปฏิบัติ

.....

.....

.....

.....

ขอขอบพระคุณที่ให้ความร่วมมือในการตอบแบบสอบถาม

Copyright by Mahidol University

APPENDIX D
RESULT OF ELECTRIC BULBS
AND AIR-CONDITIONERS SURVEY

ตาราง A1 ผลการสำรวจจำนวน ชนิด ขนาด ของหลอดไฟฟ้าและเครื่องปรับอากาศ

ระบบที่ใช้พลังงาน	อุปกรณ์	ขนาด	หน่วย	จำนวน	ชั่วโมงใช้งานเฉลี่ย/ปี	ปริมาณการใช้พลังงานไฟฟ้า (กิโลวัตต์-ชั่วโมง/ปี)
ระบบปรับอากาศ	เครื่องปรับอากาศแบบรวมศูนย์	3,600,000	BTU	15	2,000	5,616,000
ระบบปรับอากาศ	เครื่องปรับอากาศแบบแยกส่วน	12,000	BTU	60	2,000	158,400
ระบบปรับอากาศ	เครื่องปรับอากาศแบบแยกส่วน	16,000	BTU	120	1,600	337,920
ระบบปรับอากาศ	เครื่องปรับอากาศแบบแยกส่วน	18,000	BTU	68	1,500	201,960
ระบบปรับอากาศ	เครื่องปรับอากาศแบบแยกส่วน	20,000	BTU	45	750	74,250
ระบบปรับอากาศ	เครื่องปรับอากาศแบบแยกส่วน	28,000	BTU	120	2,000	739,200
ระบบปรับอากาศ	เครื่องปรับอากาศแบบแยกส่วน	30,000	BTU	40	750	99,000
ระบบปรับอากาศ	เครื่องปรับอากาศแบบแยกส่วน	32,000	BTU	60	1,500	316,800
ระบบปรับอากาศ	เครื่องปรับอากาศแบบแยกส่วน	38,000	BTU	280	2,000	2,340,800
ระบบปรับอากาศ	เครื่องปรับอากาศแบบแยกส่วน	40,000	BTU	20	750	66,000
ระบบปรับอากาศ	เครื่องปรับอากาศแบบแยกส่วน	42,000	BTU	38	750	131,670
ระบบปรับอากาศ	เครื่องปรับอากาศแบบแยกส่วน	48,000	BTU	38	750	150,480
ระบบปรับอากาศ	เครื่องปรับอากาศแบบแยกส่วน	60,000	BTU	70	750	346,500
ระบบแสงสว่าง	ฟลูออเรสเซนต์	40	Watt	13,428	2,000	1,074,240

APPENDIX E
CHI-SQUARE TESTING RESULTS

ความสัมพันธ์ระหว่างตัวแปรอิสระที่ศึกษากับการรับรู้ข้อมูลข่าวสารด้านการประหยัดพลังงาน

การศึกษาความสัมพันธ์ระหว่างตัวแปรอิสระ ได้แก่ สถานภาพของกลุ่มตัวอย่างกับการรับรู้ข้อมูลข่าวสารด้านการประหยัดพลังงาน ด้วยการใช้ค่าสถิติไคสแควร์ (Chi-Square) ปรากฏผลดังนี้

ตาราง B1 ความสัมพันธ์ระหว่างสถานภาพของกลุ่มตัวอย่างกับการรับรู้ข้อมูลข่าวสารด้านการประหยัดพลังงาน

การรับรู้ข้อมูลข่าวสารผ่านสื่อ	สถานะภาพ						Chi-Square	df	Sig.
	อาจารย์		เจ้าหน้าที่		นักศึกษา				
	Count	Column N %	Count	Column N %	Count	Column N %			
โทรทัศน์	232	79.2%	275	90.2%	337	91.3%	25.043	2	.000
หนังสือพิมพ์	210	71.7%	240	78.7%	221	59.9%	28.808	2	.000
วิทยุ	114	38.9%	120	39.3%	221	59.9%	39.491	2	.000
แผ่นพับ/ใบปลิว	192	65.5%	280	91.8%	314	85.1%	73.508	2	.000
อินเทอร์เน็ต	191	65.2%	219	71.8%	282	76.4%	10.143	2	.006
การบอกต่อ	200	68.3%	239	78.4%	243	65.9%	13.606	2	.001

Copyright by Mahidol University

จากตาราง B1 การทดสอบไคสแควร์ (Chi-Square) สามารถสรุปได้ว่า สถานภาพของกลุ่มตัวอย่าง มีความสัมพันธ์กันกับการรับรู้ข้อมูลข่าวสารด้านการประหยัดพลังงาน อย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05

ตาราง B2 ความสัมพันธ์ระหว่างสถานภาพของกลุ่มตัวอย่างกับการรับรู้ข้อมูลข่าวสารเกี่ยวกับนโยบายของรัฐด้านการจัดการพลังงาน

การรับรู้ข้อมูลข่าวสารผ่านสื่อ	สถานะภาพ						Chi-Square	df	Sig.
	อาจารย์		เจ้าหน้าที่		นักศึกษา				
	Count	Column N %	Count	Column N %	Count	Column N %			
โทรทัศน์	293	100.0%	305	100.0%	238	64.5%	2.456E2	2	.000
หนังสือพิมพ์	293	100.0%	269	88.2%	193	52.3%	2.437E2	2	.000
แผ่นพับ/ใบปลิว	293	100.0%	269	88.2%	232	62.9%	-	-	.000
อินเทอร์เน็ต	241	82.3%	277	90.8%	232	62.9%	1.645E2	2	.000
การบอกต่อ	293	100.0%	269	88.2%	224	60.7%	80.252	2	.000
ที่ทำงาน	274	93.5%	305	100.0%	32	8.7%	1.798E2	2	.000
การอบรม/ประชุม/สัมมนา	252	86.0%	277	90.8%	196	53.1%	1.538E2	2	.000

จากตาราง B2 การทดสอบไคสแควร์ (Chi-Square) สามารถสรุปได้ว่า สถานภาพของกลุ่มตัวอย่าง มีความสัมพันธ์กันกับการรับรู้ข้อมูลข่าวสารเกี่ยวกับนโยบายของรัฐในด้านการจัดการการใช้พลังงาน อย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05

Copyright by Mahidol University

ตาราง B3 ความสัมพันธ์ระหว่างสถานภาพของกลุ่มตัวอย่างกับการรับรู้ข้อมูลข่าวสารการประหยัดพลังงาน

การรับรู้ข้อมูลข่าวสารผ่านสื่อ	สถานะภาพ						Chi-Square	df	Sig.
	อาจารย์		เจ้าหน้าที่		นักศึกษา				
	Count	Column N %	Count	Column N %	Count	Column N %			
ป้ายประกาศ	252	86.0%	269	88.2%	262	71.0%	38.956	2	.000
โปสเตอร์	293	100.0%	305	100.0%	232	62.9%	2.587E2	2	.000
แผ่นพับ/ใบปลิว	293	100.0%	305	100.0%	238	64.5%	2.456E2	2	.000
การประชาสัมพันธ์	232	79.2%	183	60.0%	161	43.6%	85.730	2	.000
E-mail	218	74.4%	216	70.8%	87	23.6%	2.215E2	2	.000
กิจกรรม	261	89.1%	269	88.2%	121	32.8%	3.235E2	2	.000
การบอกต่อ	293	100.0%	269	88.2%	114	30.9%	4.416E2	2	.000
หนังสือราชการ	293	100.0%	269	88.2%	32	8.7%	7.097E2	2	.000
การประชุม	264	90.1%	119	39.0%	86	23.3%	3.078E2	2	.000

จากตาราง B3 การทดสอบไคสแควร์ (Chi-Square) สามารถสรุปได้ว่า สถานภาพของกลุ่มตัวอย่างมีความสัมพันธ์กันกับการรับรู้ข้อมูลข่าวสารการประหยัดพลังงาน ของ มหาวิทยาลัยราชภัฏสวนดุสิต อย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05

Copyright© by Mahidol University

ตาราง B4 ความสัมพันธ์ระหว่างสถานภาพของกลุ่มตัวอย่างกับการเผยแพร่ข้อมูลข่าวสาร ความรู้หรือกิจกรรมด้านการประหยัดพลังงานไฟฟ้า

วิธีการการเผยแพร่ข้อมูลข่าวสาร	สถานะภาพ						Chi-Square	df	Sig.
	อาจารย์		เจ้าหน้าที		นักศึกษา				
	Count	Column N %	Count	Column N %	Count	Column N %			
ติดป้ายประกาศ	293	100.0%	305	100.0%	369	100.0%			.000
ติดโปสเตอร์	293	100.0%	305	100.0%	369	100.0%			.000
แจกแผ่นพับ/ใบปลิว	293	100.0%	305	100.0%	369	100.0%			.000
จัดกิจกรรม	293	100.0%	305	100.0%	369	100.0%	5.613E2	2	.000
หนังสือราชการ	293	100.0%	305	100.0%	114	30.9%			.000
การประชาสัมพันธ์เสียงตามสาย	293	100.0%	305	100.0%	369	100.0%			.000
การประชุม	293	100.0%	305	100.0%	109	29.5%	5.763E2	2	.000
E-mail	261	89.1%	110	36.1%	0	.0%	5.490E2	2	.000
การบอกต่อ	293	100.0%	269	88.2%	330	89.4%	35.701	2	.000
สื่อสังคมออนไลน์ เช่น What App , Line, Facebookฯลฯ	293	100.0%	305	100.0%	369	100.0%			.000

จากตาราง B4 การทดสอบไคสแควร์ (Chi-Square) สามารถสรุปได้ว่า สถานภาพของกลุ่มตัวอย่าง มีความสัมพันธ์กันกับการเผยแพร่ข้อมูลข่าวสาร ความรู้หรือกิจกรรมด้านการประหยัดพลังงานไฟฟ้า ของ มหาวิทยาลัยราชภัฏสวนดุสิต อย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05

Copyright by Mahidol University

BIOGRAPHY

NAME	Mr. Nipon Taksin
DATE OF BIRTH	24TH JULY 1980
NATIONALITY	Thai
RELIGION	Buddhism
E-MAIL	niponets@gmail.com
JOB POSITION	UNIVERSITY STAFF
WORKPLACE	Suan Dusit Poll, Suan Dusit University 295 Nakhonratchasima Rd. Dusit District. Bangkok 10300

Copyright by Mahidol University