CHAPTER FOUR
RESULTS

This research was aimed to study factors that affect the knowledge of Thammasat University students about electricity energy saving. The objective is to study the students' knowledge levels of electricity energy saving, and the effects of personal factors such as gender, age and education levels on knowledge of electricity energy saving by using primary and secondary data.

After the SPSS program was used to process all the data, the results were derived. The analysis was divided into 4 Parts:

4.1 Students' Demography

4.2 Students' knowledge of electricity energy saving

4.3 Students' suggestions on electricity energy saving

4.4 Test of Hypotheses

4.1 STUDENTS' DEMOGRAPHY

The demographic information of the respondents is presented in the form of numbers and percentages on table 1A below.

Table 1A shows frequency and percentage of students' demography

	Frequency	**Percent**
Gender		
Male	186	46.7
Female	212	53.3
Total	**398**	**100.0**
Age		
15-24 years old	304	76.4
25-34 years old	69	17.3
35-44 years old	19	4.8
45-54 years old	6	1.5
Total	**398**	**100.0**

(Table continue)

Table 1A (Table continued)

	Frequency	Percent
Level of Education		
Bachelor's degree	300	75.4
Graduate Diploma	7	1.8
Master's degree	87	21.9
Doctor's degree	4	1.0
Total	**398**	**100.0**

Gender

Table 1A presents frequency of the data for gender. The percentage of male and female students was 46.7% males and 53.3% females.

Age

Table 1A provides descriptive statistics on the age of the students. 76.4% of those students were 15-24 years of age, 17.3% were 25-34 years of age, 4.8% were 35-44 years of age and 1.5% were 45-54 years of age.

Level of Education

Table 1A presents the frequency of the data indicating that the majority of students (75.4%) responding the questionnaire held a Bachelor's degree, with 22.9% having completed their Master's degree or Doctoral Degree. Only 1.8% have completed a Graduate Diploma.

4.2 STUDENTS' KNOWLEDGE OF ELECTRICITY ENERGY SAVING

Table 2A shows Mean ($\bar{x}$), Standard Deviation (S.D.), and the knowledge levels of electricity energy saving of students.

Item	Questions	$\bar{x}$	S.D.	Knowledge level
The situation of electricity in Thailand				
1	Thailand could generate enough electricity for domestic use and for sales to neighboring countries.	0.65	0.47	moderate
2	Thailand has enough water reserve in dams to generate electricity for domestic use.	0.60	0.49	low
3	Thailand has to build nuclear power plants to generate electricity.	0.58	0.49	low
4	Lignite is a primary source for generating electricity and heavy fuel oil (HFO) is a secondary source.	0.44	0.49	low
5	Thailand has to import some crude oil from foreign countries to generate electricity.	0.79	0.40	moderate
6	Economic growth is an important factor in insufficient electricity.	0.77	0.42	moderate
	Total average	**0.63**	**0.19**	**low**
Demand Side Management program (DSM)				
7	EGAT is the organizer of the Demand Side Management program.	0.90	0.30	high
8	The objective of the Demand Side Management program is to encourage the efficient use of electricity in Thailand.	0.87	0.33	high
9	Thin tube is the first equipment promoted in DSM program.	0.72	0.45	moderate
10	With DSM campaign, thin tube could replace low quality tube in the market.	0.45	0.49	low
11	The No. 5 label products campaign is part of the DSM program.	0.81	0.39	moderate
12	The No. 5 label brown rice is a campaign that promotes three times rubbing paddy husk off for clean rice.	0.63	0.48	low
13	Green Learning Room program is aimed to build awareness of electricity energy conservation among school children from kindergarten to high school level.	0.80	0.40	moderate
	Total average	**0.73**	**0.16**	**moderate**

(Table continue)

Table 2A (Table continued)

Item	Questions	$\bar{x}$	S.D.	Knowledge level
Unit of electricity and electrical equipment				
14	One unit equals one kilowatt per hour	0.80	0.39	moderate
15	Kilowatt per hour or unit is the electrical energy used by electrical equipment. Calculated by the number of Kilowatts multiplied by a period of time.	0.82	0.38	moderate
16	Watt is the electricity unit. In the same period of time equipment that has more Watts will consume more electricity than the equipment that has less Watts.	0.88	0.32	high
17	The money that we have to pay is calculated by the number of units multiplied by electrical rate per unit.	0.93	0.26	high
18	The electrical equipment that has cheap price may consume more electricity and has a short life.	0.72	0.44	moderate
19	A fluorescent tube gives more light than a fat tube.	0.74	0.44	moderate
20	The highest electrical consuming equipment in our house is an air conditioner.	0.59	0.49	low
21	The thick wall refrigerator could protect from outside heat so food becomes cold easily and consumes less electricity.	0.75	0.43	moderate
22	A water heater consumes around 900 – 4800 Watts depending on size.	0.83	0.37	moderate
23	An iron has a temperature mode controlled by users and when it reaches set temperature, it automatically switches itself off.	0.82	0.38	moderate
24	A microwave tumble dryer is expensive but it saves electricity.	0.45	0.49	low
	Total average	**0.78**	**0.16**	**moderate**
How to choose electrical equipment				
25	We should buy electrical equipment that has low maintenance cost and is easy to fix and find spare parts for.	0.67	0.47	moderate
26	We should buy a big size television because it consumes electricity equal to a standard size television.	0.77	0.42	moderate
27	We should buy a one-door refrigerator because it consumes less electricity than a two-door refrigerator.	0.47	0.50	low
28	We should buy a thick wall refrigerator in order to prevent the outside heat from entering.	0.77	0.42	moderate
29	We should buy a floor air-conditioner because it fits the big room.	0.35	0.47	low

(Table continue)

Table 2A (Table continued)

Item	Questions	$\bar{x}$	S.D.	Knowledge level
30	We should buy an air-conditioner that fits our room size.	0.95	0.21	high
	Total average	**0.66**	**0.17**	**Moderate**
How to use electrical equipment				
31	Plugging a television set in when it is not used causes the loss of electricity.	0.87	0.33	high
32	It is not necessary to unplug a television any time we go out because this causes the plug to have a short life.	0.80	0.39	moderate
33	Too much stuff in a refrigerator is the reason for electricity waste.	0.85	0.35	high
34	Do not open a refrigerator too often or put hot food in it because the heat will go into the refrigerator so it has to restart cooling itself.	0.92	0.26	High
35	Air-conditioner in the bedroom should be set at 23 degrees to save electricity.	0.81	0.39	moderate
36	Growing trees could reduce the work load of air conditioners.	0.85	0.35	high
37	Opening the window while the air-conditioner works leads to more consumption of electricity.	0.84	0.36	high
38	Switching on the light tube or electrical equipment only when necessary could reduce electricity consumption of air-conditioners.	0.85	0.35	High
	Total average	**0.85**	**0.16**	**High**
How to maintain electrical equipment				
39	Always checking electricity leaks in electrical equipment could reduce the electricity energy consumption.	0.97	0.16	high
40	Checking of refrigerator could reduce electricity consumption.	0.93	0.24	high
41	We should clean the filter at the back of refrigerator once per five years.	0.49	0.50	low
42	Cleaning the filter in front of the air-conditioner does not help in electricity energy saving.	0.74	0.44	Moderate
43	Clean the filter of the air-conditioners every month or more if necessary.	0.90	0.30	high
44	We should clean air-conditioners at least once per year.	0.87	0.33	High
	Total average	**0.81**	**0.15**	**moderate**

From Table 2A, it was found that the students' knowledge is classified into 6 aspects as follow.

1. **The situation of electricity in Thailand**

The students' level of knowledge of the situation of electricity in Thailand was low (Mean = 0.63). However each student's knowledge level is not significantly different (Standard Deviation = 0.19).

2. **Demand Side Management program (DSM)**

Students have moderate knowledge level of the Demand Side Management program (Mean = 0.73). There is no significant difference in term of the knowledge level of each student (Standard Deviation = 0.16).

3. **Units of electricity and electrical equipment**

Students have moderate knowledge level of Units of electricity and electrical equipment (Mean = 0.78). This kind of knowledge was found to be at similar levels for each student (Standard Deviation = 0.16).

4. **How to choose electrical equipment**

Students have moderate knowledge of how to choose electrical equipment (Mean = 0.66). There are no significant differences in term of knowledge levels of each student (Standard Deviation = 0.17).

5. **How to use electrical equipment**

Students' knowledge of how to use electrical equipment was found to be high (Mean = 0.85). There are no significant differences in term of knowledge levels of each student (Standard Deviation = 0.16).

6. **How to maintain electrical equipment**

Students were found to be moderately knowledgeable about how to maintain electrical equipment (Mean = 0.81). There are no significant differences in term of knowledge levels of each student (Standard Deviation = 0.15).

Table 2B shows the all levels of knowledge of electricity energy saving in 6 aspects.

Item	Aspects	$\bar{x}$	S.D.	Knowledge level
1	The situation of electricity in Thailand	0.63	0.19	low
2	Demand Side Management program (DSM)	0.73	0.16	moderate
3	Unit of electricity and electrical equipment	0.78	0.16	moderate
4	How to choose electrical equipment	0.66	0.17	moderate
5	How to use electrical equipment	0.85	0.16	high
6	How to maintain electrical equipment	0.81	0.15	moderate
	Total average	**0.74**	**0.09**	**moderate**

From table 2B on average students have a moderate knowledge level of electricity energy saving in all aspects (Mean = 0.74). Students' knowledge was not found to be significantly different between respondents (Standard Deviation = 0.09).

4.3 STUDENTS' SUGGESTIONS ON ELECTRICITY ENERGY SAVING

After analyzing the returned questionnaires of respondents, the suggestions which were given in open-ended questions are divided into 4 aspects.

- **Demand Side Management program (DSM).** Most students thought that this program is useful for Thailand and Thai people so EGAT should implement it continuously.
- **How to choose electrical equipment.** Most students suggested that we should buy No. 5 label electrical equipment; the manufacturers should reduce electrical equipment prices; EGAT should set an indicator of electrical consumption for each item of electrical equipment, and the retailer should clearly explain how to choose electrical equipment.
- **How to use electricity.** Most students suggested that we should use electricity only when necessary; EGAT should encourage people to avoid using electricity in peak load time; the manufacturers should reduce solar cell prices; we should make a sticker which contains easy words to recognize and remember and post them in many places.

- **How to maintain electrical equipment.** Most students advised EGAT to provide people with electrical equipment maintenance manuals which are easy to understand and to set up training programs for people.

4.4 HYPOTHESES TESTING

1) Male and female students have different levels of knowledge of electricity energy saving.

Table 4A

Gender / knowledge of…	Female (n=212)		Male (n=186)		t-value
	Mean	**SD.**	**Mean**	**SD.**	
The situation of electricity in Thailand	0.66	0.19	0.61	0.18	0.005*
Demand Side Management program (DSM)	0.74	0.15	0.73	0.18	0.669
Unit of electricity and electrical equipment	0.78	0.16	0.77	0.16	0.442
The way to choose electrical equipment	0.65	0.18	0.67	0.17	0.361
The way to use electrical equipment	0.88	0.13	0.81	0.19	0.000*
The way to maintain electrical equipment	0.83	0.14	0.80	0.15	0.064
Overall knowledge	**0.76**	**0.08**	**0.73**	**0.10**	**0.005***

*** t < 0.05**

In terms of gender, table 4A shows that female students have more knowledge of electricity energy saving than male students. The different levels of knowledge between two genders were found significant in 3 aspects i.e. the situation of electricity in Thailand, how to use electrical equipment, and the overall knowledge of electricity energy saving at 0.005, 0.000, and 0.005 respectively ($t<0.05$). Their knowledge of other aspects is not significantly different.

2) Students of different ages have different levels of knowledge of electricity energy saving.

Table 4B

Age / knowledge of…	15-24Yrs old (n=304)		25-34Yrs old (n=69)		35-44Yrs old (n=19)		45-54Yrs old (n=6)		
	Mean	**SD.**	**Mean**	**SD.**	**Mean**	**SD.**	**Mean**	**SD.**	**p-value**
The situation of electricity in Thailand	0.63	0.19	0.66	0.16	0.64	0.18	0.75	0.13	0.259
Demand Side Management program (DSM)	0.73	0.17	0.76	0.14	0.77	0.14	0.78	0.14	0.413
Unit of electricity and electrical equipment	0.77	0.16	0.81	0.14	0.74	0.20	0.75	0.20	0.267
How to choose electrical equipment	0.66	0.17	0.64	0.20	0.62	0.17	0.63	0.16	0.609
How to use electrical equipment	0.83	0.18	0.91	0.09	0.94	0.07	0.81	0.20	0.000*
How to maintain electrical equipment	0.80	0.15	0.86	0.13	0.85	0.11	0.94	0.08	0.002*
Overall knowledge	**0.74**	**0.09**	**0.77**	**0.07**	**0.76**	**0.08**	**0.78**	**0.07**	**0.021***

*** p<0.05**

In terms of age, table 4B indicates that there is a relationship between age of students and their knowledge of electricity energy saving. There are statistically significant differences in 3 aspects i.e. how to use electrical equipment, how to maintain electrical equipment, and the overall knowledge of electricity energy saving at 0.000, 0.002, and 0.021 respectively ($p<0.05$). The other aspects of knowledge are not significantly different.

Full details of significant differences of knowledge among different age groups are explained below.

Table A

Mean Differences	Mean (X)	15-24 Years old	25-34 Years old	35-44 Years old	45-54 Years old
15-24 Years old	0.83	- -	0.000*	0.004*	0.764
25-34 Years old	0.91	- -	- -	0.425	0.155
35-44 Years old	0.94	- -	- -	- -	0.083
45-54 Years old	0.81	- -	- -	- -	- -

2.1) ***Age VS knowledge of how to use electrical equipment***

Using Scheffé's Post-Hoc Multiple Comparison, in terms of knowledge levels table A reveals a statistically significant difference ($p<0.05$) between students aged 15-24 years old and the other two age ranges (25-34 years old and 35-44 years old).

Table B

Mean Differences	Mean (X)	15-24 Years old	25-34 Years old	35-44 Years old	45-54 Years old
15-24 Years old	0.80	- -	0.003*	0.105	0.021*
25-34 Years old	0.86	- -	- -	0.945	0.194
35-44 Years old	0.85	- -	- -	- -	0.222
45-54 Years old	0.94	- -	- -	- -	- -

2.2) ***Age VS knowledge of how to maintain electrical equipment***

Using Scheffé's Post-Hoc Multiple Comparison, table B reveals a statistically significant ($p<0.05$) differences in levels of knowledge between students aged 15-24 years old and the other two groups (aged 25-34 years old and 45-54 years old).

Table C

Mean Differences	Mean (X)	15-24 Years old	25-34 Years old	35-44 Years old	45-54 Years old
15-24 Years old	0.74	- -	0.004*	0.274	0.300
25-34 Years old	0.77	- -	- -	0.613	0.929
35-44 Years old	0.76	- -	- -	- -	0.718
45-54 Years old	0.78	- -	- -	- -	- -

2.3) ***Age VS overall knowledge of electricity energy saving***

Using Scheffé's Post-Hoc Multiple Comparison, table C reveals a statistically significant ($p<0.05$) differences in term of knowledge between students aged 15-24 years and students aged 25-34 years.

3) The students with different education levels have different knowledge levels of electricity energy saving.

Table 3

Education level / knowledge of…	Bachelor's degree **(n=300)**		Graduate Diploma**(n=7)**		Master's degree**(n=87)**		Doctoral degree **(n=4)**		
	Mean	**SD.**	**Mean**	**SD.**	**Mean**	**SD.**	**Mean**	**SD.**	**p-value**
The situation of electricity in Thailand	0.62	0.19	0.59	0.08	0.67	0.16	0.75	0.21	0.160
Demand Side Management program (DSM)	0.73	0.17	0.79	0.11	0.75	0.14	0.85	0.11	0.258
Unit of electricity and electrical equipment	0.77	0.16	0.66	0.30	0.80	0.14	0.75	0.10	0.131
The way to choose electrical equipment	0.67	0.17	0.50	0.19	0.64	0.18	0.75	0.21	0.047*
The way to use electrical equipment	0.83	0.18	0.92	0.09	0.91	0.10	0.87	0.10	0.000*
The way to maintain electrical equipment	0.80	0.15	0.90	0.13	0.85	0.12	1.00	0.00	0.001*
Overall knowledge	**0.74**	**0.09**	**0.73**	**0.11**	**0.77**	**0.07**	**0.83**	**0.04**	**0.007***

*** p<0.05**

From table 3, the results of this study reveal that education levels have a relationship with knowledge of electricity energy saving. There are statistically significant differences in 4 aspects i.e. how to choose electrical equipment, how to use electrical equipment, how to maintain electrical equipment, and the overall knowledge of electricity energy saving at 0.047, 0.000, 0.001, and 0.007 respectively ($p<0.05$). For the other aspects the difference is not statistically significant.

Table A

Mean Differences	Mean (X)	Bachelor's degree	Graduate Diploma	Master's degree	Doctoral degree
Bachelor's degree	0.67	- -	0.013*	0.288	0.375
Graduate Diploma	0.50	- -	- -	0.035*	0.025*
Master's degree	0.64	- -	- -	- -	0.260
Doctoral degree	0.75	- -	- -	- -	- -

3.1) *Level of education VS how to choose electrical equipment*

Using Scheffé's Post-Hoc Multiple Comparison, table A reveals the statistical significance ($p<0.05$) of different knowledge levels between Bachelor's degree students and Graduate Diploma students. And the knowledge level of Graduate Diploma students is significantly different from the Master's degree and Doctoral degree students.

Table B

Mean Differences	Mean (X)	Bachelor's degree	Graduate Diploma	Master's degree	Doctoral degree
Bachelor's degree	0.83	- -	0.128	0.000*	0.605
Graduate Diploma	0.92	- -	- -	0.838	0.607
Master's degree	0.91	- -	- -	- -	0.636
Doctoral degree	0.87	- -	- -	- -	- -

3.2) ***Level of education VS how to use electrical equipment***

Using Scheffé's Post-Hoc Multiple Comparison, table B reveals the statistical significance ($p<0.05$) of differences of knowledge between Bachelor's degree students and Master's degree students.

Table C

Table C **Mean Differences**	**Mean (X)**	**Bachelor's degree**	**Graduate Diploma**	**Master's degree**	**Doctoral degree**
Bachelor's degree	0.80	- -	0.072	0.004*	0.008*
Graduate Diploma	0.90	- -	- -	0.387	0.305
Master's degree	0.85	- -	- -	- -	0.055
Doctoral degree	1.00	- -	- -	- -	- -

3.3) ***Level of education VS how to maintain electrical equipment***

Using Scheffé's Post-Hoc Multiple Comparison, table C reveals the statistical significance ($p<0.05$) of differences of knowledge between Bachelor's degree students and Master's degree and Doctoral degree students.

Table D

Mean Differences	**Mean (X)**	**Bachelor's degree**	**Graduate Diploma**	**Master's degree**	**Doctoral degree**
Bachelor's degree	0.74	- -	0.779	0.003*	0.053
Graduate Diploma	0.73	- -	- -	0.229	0.084
Master's degree	0.77	- -	- -	- -	0.233
Doctoral degree	0.83	- -	- -	- -	- -

3.4) ***Level of education VS overall knowledge of electricity energy saving***

Using Scheffé's Post-Hoc Multiple Comparison, table D reveals the statistical significance ($p<0.05$) of knowledge differences between Bachelor's degree students and Master's degree students.