

# Tracking Selection Criteria of Solar Panels in Consumer Market



**Daffodil International University**



## **Tracking Selection Criteria of Solar Panels in Consumer Market**

Prepared For:

**Reza Shahbaz Hadi**

Senior lecturer

Department of Business Administration

Faculty of Business and Economics

Daffodil International University

Prepared By:

**Zahid Hasan**

ID: 111-11-1923

Major in Marketing

Program: BBA

Department of Business Administration

Faculty of Business and Economics

Daffodil International University

**Date of Submission: 08<sup>th</sup> November, 2014**

## Letter of Transmittal

8<sup>th</sup> November, 2014

**Reza Shahbaz Hadi**

Senior Lecturer

Department of Business Administration

Faculty of Business and Economics

Daffodil International University

**Subject: Submission of the Internship Report on “Tracking Selection Criteria of Solar Panels in Consumer Market”.**

Dear Sir,

This is a great honor for me to submit the internship report on the topic titled “**Tracking Selection Criteria of Solar Panels in Consumer Market**”. This has given me great opportunity to enrich my knowledge about renewable energy business sector in Bangladesh.

Now, I have placed before you this report for your kind approval. I hope that my report will satisfy you and the learned members of the examination committee.

Yours Faithfully,

.....  
**Zahid Hasan**

ID: 111-11-1923

Major in Marketing

BBA Program

Department of Business Administration

Faculty of Business and Economics

Daffodil International University

## **Declaration**

I hereby declare that this internship report has been prepared by me under the supervision of Reza Shahbaz Hadi, Senior Lecturer, Department of Business Administration, Daffodil International University.

Submitted by:

.....

**Zahid Hasan**

ID: 111-11-1923

Major in Marketing

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Department of Business Administration

Faculty of Business and Economics

Daffodil International University

## Letter of Acceptance

This is to certify that Zahid Hasan, ID: 111-11-1923, Program: BBA, Major in Marketing, is a regular student of Bachelor of Business Administration, Daffodil International University. He has successfully completed his internship program at AVA Renewable Energy Ltd, Rozi Villa (2<sup>nd</sup> floor) Jamgora, Ashulia, Savar, Dhaka-1349, and has prepared his internship report under my direct supervision. His internship topic is “Tracking Selection Criteria of Solar Panels in Consumer Market”.

This report is recommended for submission.

I wish his every success in life.

.....  
**Reza Shahbaz Hadi**  
Senior Lecturer  
Department of Business Administration  
Faculty of Business and Economics  
Daffodil International University

## **Acknowledgement**

At first, I would like to express my gratitude to almighty Allah for enabling me the strength and opportunity to complete the report successfully.

Internship is a part of the Bachelor of Business Administration (BBA) program that provides on the job experience for the students. The students get chance to work closely with the people of the organization. The internship program enables a student to develop their analytical skills and scholastic aptitudes and to have real-life orientation of the academic knowledge.

I like to thank from the core of my heart to the internship supervisor, Mr. Reza Shahbaz Hadi, Senior Lecturer, Department of Business Administration, Daffodil International University, who helped me in every step of my internship.

I am thankful to Nurul Huda Remon (Sr. Manager, AVA Renewable Energy Ltd.) for his co-operation, valuable guidance, and generous support providing me with necessary information, without him my efforts would have been hardly possible.

Finally, I must acknowledge with due respect the constant support and patients of my parents.

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## List of Acronyms

<b>Acronym</b>	<b>Elaboration</b>
AGM	Assistant General Manager
AH	Ampere-Hour
BTRC	Bangladesh Telecommunication Regulatory Commission
DESCO	Dhaka Electric Supply Company
DGM	Deputy General Manager
DMD	Deputy Managing Director
GHG	Green House Gas
GM	General Manager
ICB	Investment Corporation of Bangladesh
IPS	Instant Power Supply
MD	Managing Director
NGO	Non Government Organization

## **Executive Summary**

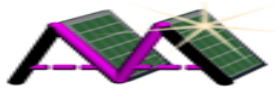
Human always wants to make his life easier. As the time passes by, various problems are faced by humans. Now a day, the greatest problem which is existing all over the country is load shedding. Various substitute sources are being used to solve this problem, but the sources are not adequate enough due to economic and environmental reasons. One of these sources is solar energy which is emerging in human lives.

Like other developed and developing countries, solar business is a potential and developing sector in Bangladesh. I wanted to know about the possible market acceptance of solar panels, and consumers' reference of features in solar panels, problems with solar business. I worked for AVA Renewable Energy Ltd. where I got the practical knowledge. I worked with AVA solar by handling its various running projects, talking with employees, and discussing with customer.

I interviewed 48 people of Rangpur district with the help of a structured questionnaire. I divided the product profiles into 3 major attributes: capacity, installment, and price. There has been found 16 packages of different capacity, installment, and price. I found that people are interested in using solar panels. It has been found that people prefer 100w panel and want to pay BDT 1500-2000 in 12 monthly installments.

Companies dealing with solar panels need to overcome some lacking. The electronics products which are used with solar panel is expensive. The company should decrease the price along with decreasing its installment prices to create new demand.

After working with AVA Renewable Energy Ltd. I learnt the present scenario of solar panel market. Bangladesh can be a great manufacturer of solar panels. The government should increase its focus and subsidy contribution upon the solar business sector.



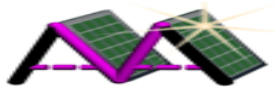
## **Chapter 1: Introduction**

Today's world is fully dependent on electric power supply. In every step of our lives, electricity has its necessity. As the time passes by, the demand for energy is increasing with the increase in the world's population. From different large corporation to small households, people need energy to perform daily tasks. As the science and technology is developing, people's lives are also becoming more and more complex. To meet energy demands, Dhaka Electric Supply Company (DESCO) is giving the power supply. But it is getting tougher to ensure electricity in all sectors. That's why, people are facing load shedding. People are using substitute sources like, IPS (Instant Power Supply), Generator, Candles etc. to get rid of this problem. But these alternatives can hardly serve the total demand during load shedding.

Bangladesh is developing country. Here all people are not able to lead life expensively. If they use IPS or generator during load shedding, they will face very high price of it along with the maintenance cost. Electricity is required to recharge the battery of IPS. The IPS requires a lot of electricity power to recharge the battery that causes the electricity bill to be very high. Besides, IPS requires changing the battery after every two years that will incur additional costs. In rural area IPS is unable to provide the power supply because there is not enough electricity to recharge the battery even IPS cannot supply the power more than 4 or 5 hours continuously. Generator requires fuel for providing the supply. Generator consumes 1 liter diesel or octane for an hour. The price of diesel or octane is already high and it is increasing day by day.

In this situation, renewable energies such as solar panel can be a good substitute to supply energies for household along with other sectors. Today, many solar companies exist. They provide a complete solar package at reasonable price so that every class of people can afford. This report intends to investigate whether there is any future prospect of solar energy in Bangladesh. In Bangladesh, near about 30% people know about solar energy but only 3% people are using it for their daily purposes (Source: BTRC, 2014). Primarily solar energy was used for households to run light and fan. But today solar energy is being used for larger projects like power supply of a shopping mall, irrigation projects, etc. Many countries are using solar power to run vehicles also. This culture is also seen in Bangladesh as well.

For a developing country like Bangladesh people can easily use solar panel because it has lower cost. People can pay the price of solar energy through installments. Many companies exist in

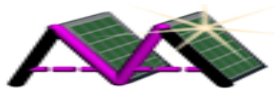


Bangladesh who are providing easily affordable installment packages. It consumes the power from the sunlight through a panel which is set on the roof top of households so that it does not require any other sources like electricity or any other fuel to recharge its battery. The products which are essential to provide the supply like panel or battery are given a long time warranty so that they ensure a low maintenance cost. Lights or fans which are run with the power do not consume much energy. The battery is rechargeable even in low power of sun.

This report is divided into seven chapters. Chapter one introduces the report along with the background, scope, objectives, significance, and limitations of this study. Chapter two is about company overview, it covers history of the company, vision, objective, hierarchy corporate information etc. Chapter three discusses literature review to identify attributes and levels. Chapter four is about the methodology which consists of research type, target population, sample size, data sources, and data analysis tools and statistical tools. Data analysis is given in chapter five which includes product profiles for AVA solar, ranges of part worthy and relative importance. Chapter six highlights the findings and discussion. Some recommendations and concluding remarks are given in chapter seven.

## **1.1 Background of the Study:**

In the world, without the practical knowledge, theoretical knowledge is valueless. From this point of view, Department of Business Administration of Daffodil International University has introduced an internship program with a view to achieving practical knowledge associated with the different fields of business. Therefore, after academic education this internship program is a great opportunity to see the real business world, acquire practical knowledge, and become a smart business professional. I have done my internship in AVA Renewable Energy Ltd. Solar Company. I am very much grateful to the authority of AVA Renewable Energy Ltd. for giving me the opportunity to complete my internship in this organization. Solar energy can be a great source of power supply to the people of Bangladesh. By selecting this topic I tried to aware the people of the solar energy. Besides I surveyed a good number of solar panel users and non users. I tried to know the reason for not using the solar energy. I selected a specific area so that I could get the practical response from them.



## **1.2 Objectives of the Study:**

The main objective of the report is to track the selection criteria of solar panels for consumer decision making. Apart from this, the report has following specific objectives:

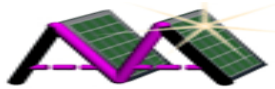
- To know the consumer demand of solar panel.
- To find what elements are necessary to sell a solar panel.
- To identify which package of solar panel attracts consumer mostly.
- To provide AVA Renewable Energy Ltd. about its business potentials.

## **1.3 Scope of the Study:**

This study is an outcome of internship program that gave me job oriented experiences. The data are generated by interviewing targeted people of different classes who are the heads of their families. They are using or not using substitute sources at the time of load shedding. Duration of the study was two months. Since this is a formal academic study, the scope of the study was not very detailed. The study covers overall possibilities of solar energy and marketing. To complete the study I surveyed some people of Rangpur district to know the feedback from them. I also talked about the AVA products to know which package of solar panel is more demandable to the consumers.

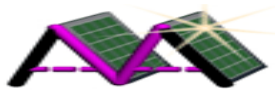
## **1.4 Importance of the Study:**

Human being has always been in search of new and better products and services. In the process, societies forever demand and produce all kinds of goods and services. In case of solar energy, people are trying to get the latest technology so that they can easily consume it. I think this study is helpful because in this study I tried to give people some valuable information. I told them about the importance of solar energy. If the people start using solar panel they will be benefited in financial and environmental ways. Because solar does not require any fuel, the environment will not be polluted. On the other hand solar companies are providing panels with installment system. Middle or lower income people can easily afford it. This report will be helpful to AVA Renewable Energy Ltd. also. I made up this report after a long research about solar panel. People's feedback, demand, acceptance, thought about solar panel, etc. are written in my report. The company can easily use this information for its betterment.



### **1.5 Limitations of the study**

No research is done without limitations. For completing this study, I faced several limitations and problems. I got less time to complete the recharge. I completed the survey within 3 days although it required at least 7 days. Some data may be missed for limitation of the time. It happened that while collecting information some people did not want to give time. Some people did not pay any interest to the survey. Many people hid the real information and provided wrong information. People wanted to know some information about the company which was fully confidential. I had to hide the information to them. During the time of data collection, many people thought I had gone to sell solar panel which was a fully negative thought.



## **Chapter 2: Company overview: Ava Renewable Energy Ltd.**

### **2.1 History:**

AVA Renewable Energy Ltd. is the leading developer and manufacturer of solar modules in Bangladesh. The company was founded in Mamunnagor, Sarabo, Kashimpur, Gazipur in 2007 and is proud of its Bangladeshi heritage. Technical know-how, a desire to always develop and evolve, and an uncompromising approach to quality and service are the main principles of the company. Some energetic, young, self motivated and hard working entrepreneurs established this plant in Bangladesh for the first time from their social commitment. AVA is trying to do something for the common people of Bangladesh and also playing a significant role to protect the earth from the GHG (Green House Gas) with its tiny abilities. AVA Renewable Energy Ltd. has become a trusted name in the solar business sector in Bangladesh. From its very inception, the company has owned confidence and goodwill from its clients. Within a short span of time, AVA has grown into a renowned and dependable organization.

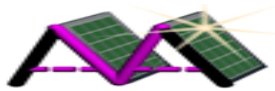
### **2.2 Vision:**

More than an industrial venture, AVA solar is challenged and committed to contribute to change Bangladesh into a country which is self-reliant on sustainable clean energy.

### **2.3 Objectives of AVA Renewable Energy Ltd:**

The main mission of AVA Renewable Energy Ltd. is to be the market leader in the solar business sector in Bangladesh. The company has a clear set of objectives that will help to achieve its main business mission, which is “Effective Participation in Economic and Social development”. To attain its goals, the company outlines two major objectives that are:

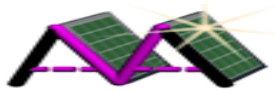
<b>Business Objectives</b>	<ul style="list-style-type: none"><li>• Participation to solve unemployment problems.</li><li>• Business diversification.</li><li>• Motivating customers to purchase quality products.</li><li>• Improving profits to have greater business strength.</li><li>• Considering each and every unit of the company as a family.</li></ul>
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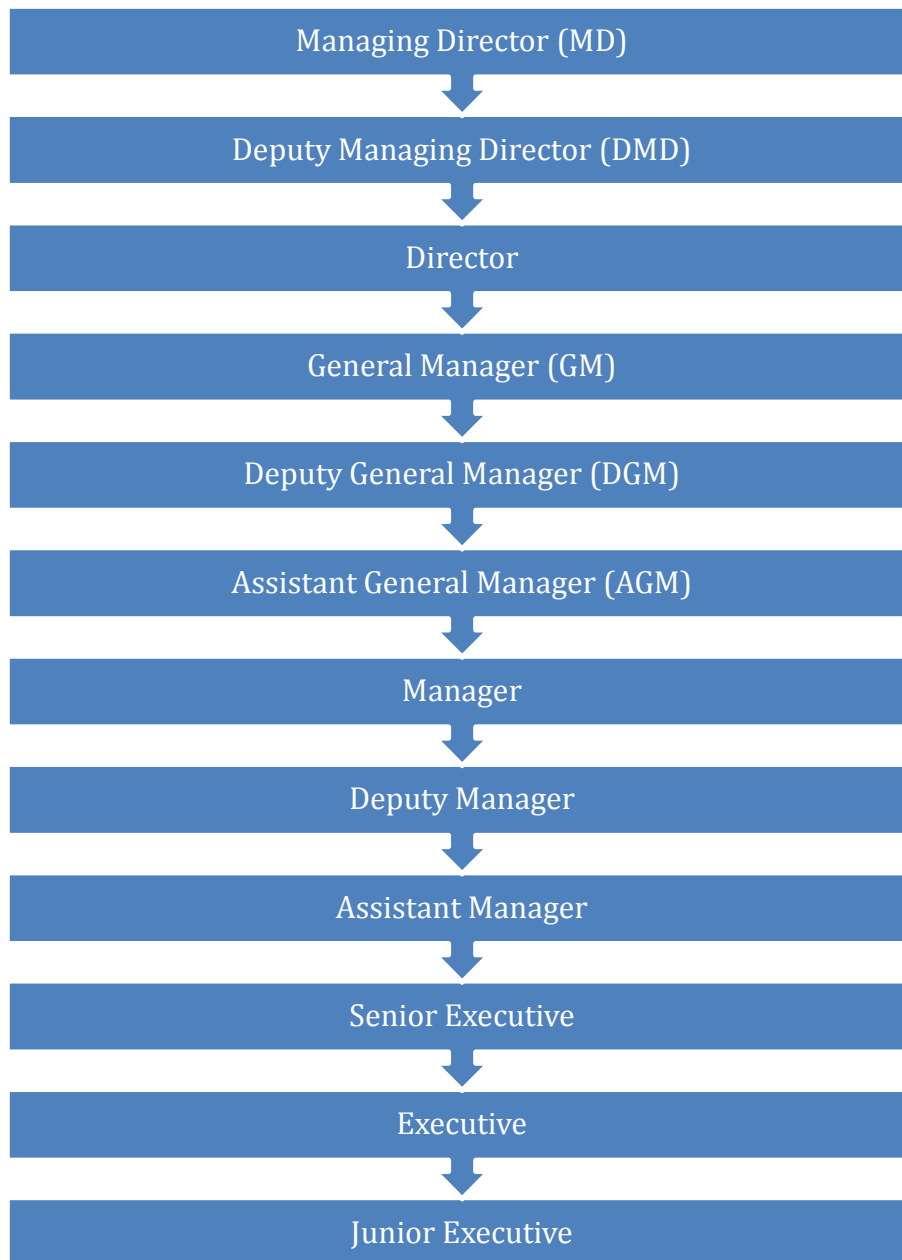
	<ul style="list-style-type: none"><li>• Increasing market share.</li></ul>
<b>Marketing Objectives</b>	<ul style="list-style-type: none"><li>• Increasing the sales.</li><li>• Providing maximum services and after sales service to the customers.</li><li>• Keeping up-to-date information about competitor's activities.</li><li>• Reducing the expenses.</li><li>• Cultivating new customers.</li></ul>

**Table 1: Objectives of AVA Renewable Energy Ltd.**





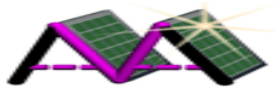
## **2.4 Hierarchy of AVA Renewable Energy Ltd:**



**Figure 1: Hierarchy of AVA Renewable Energy Ltd.**

## **2.5 Commitments of AVA Renewable Energy Ltd:**

AVA Renewable Energy Ltd. is highly committed to the customers to provide the best product. That's why it follows strict methodology of a corporate culture. It mostly focuses on discipline.



The employees are ordered to come on time. They are not allowed to leave the office before ending time. The employees are honest and sincere. After joining the company, most of them provide service for a long time. Another commitment that AVA follows is creativity. AVA always appreciates new ideas so that it can implement the ideas to its projects and for the development of the products along with customer satisfaction. AVA is totally committed to handle the projects and completion of the projects in time. Customers' feedbacks are also good about the products they use. The main reason of the success of AVA is it performs all the tasks through teamwork. When one project is run the entire employees, even in higher level also, handle that. In serving customers, AVA follows the "Customers-First" concept; after all the products are made for customers. For serving customers, it focuses on the quality of the products. It always tries to improve its product quality so that the customers could get the modern product. It also tries to get the feedback or response from the customers for the betterment of its product.

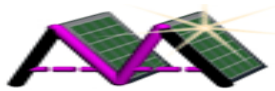
## **2.6 Company Profile:**

Type of Business	Solar Panel Business.
Type of the Organization	Private Ltd.
Company Incorporation Certificate	C-69384 (1895)/07
Import Registration Certificate	Ba-0206797
TIN Certificate	003-202-1471/Co-3, Dhaka
VAT No.	5171015800
No of skilled Manpower	50 Nos
Total No. of Manpower	80
No of Executed Project	9 Nos

**Table 2: Company Profile**

## **2.7 Corporate Information:**

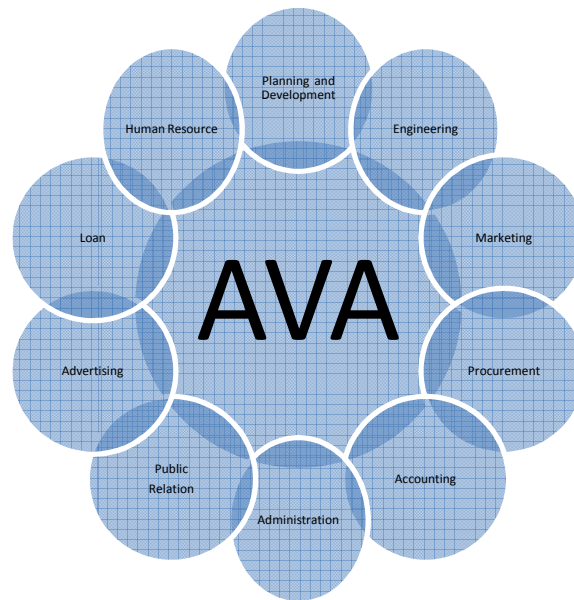
Initially AVA Renewable Energy Ltd had the financial support from Investment Corporation of Bangladesh (ICB) till September, 2010. From September, 2010 to till now AVA Renewable



Energy Ltd has a complete package of financial support from Mercantile Bank Ltd., Nayabazaar Branch, Dhaka.

## **2.8 Department of AVA Renewable Energy Ltd:**

Office layout is divided into 10 sections to ensure smooth execution and implementation of their projects given as follows:

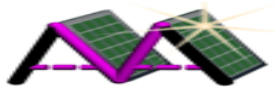


**Figure 2: Department of AVA Renewable Energy Ltd.**

## **2.9 Physical Location:**

Corporate Office & Factory	Mamunnagar (Chokroborty), Sarabo, Kashimpur, Gazipur
Overseas Office	CMAX Consulting & Computers 4629. 10th Avenue N, Lake Worth, FL-33463, USA Tel: 1-(561)-202-6620, Fax: 1-561-202-6619 E-mail: ckabir7@gmail.com

**Table 3: Physical Location**



### **Chapter 3: Literature Review**

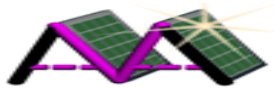
AVA Renewable Energy Ltd. is the most prominent solar company in our country. It provides the best solar panel to the people. The services derived from the panel provide supreme services. One can run light, fan, TV, etc with the power of this solar panel. It has capacity based solar panels. It has the lowest 10w to the highest 135w solar panel. Every panel has its own battery capacity. People can use at least 3w LED light in several quantity (Max. 9 in numbers). From 75w to 135w people can use 12w fan and 30w to 135w LCD/LED TV. It also provides warranty to the electronic goods. They provide solar panel for 20 years, LED lamp for 3 years, battery for 5 years, and charge controller for 3 years.

Solar energy is preserved into a battery for further use. Various Ampere-Hour (AH) of battery is available for various solar panels. Battery capacity depends upon the capacity of the solar panel. According to the 10w solar panel it has 15 Ah capable battery and for 135w it has 135 Ah battery. In case of using fan or TV, light should be relaxed.

Based on capacity of solar panel, different prices are available. The prices are easily affordable to the people. A full package of solar energy is included with a charge controller, frame, and cables along with light, TV, fan, etc. The lowest package price is 100 BDT and the highest is 46100 BDT. In AVA Renewable Energy Ltd it has 13 packages and thus it has 13 types of price packages.

To easily consume the packages, AVA Renewable Energy Ltd introduces some installment of 12 months, 24 months, and 36 months. In 12 months people can pay the price without interest but if they want to pay it in 24 or 36 months, they have to count interest.

AVA solar provides the best solar products. The panel which is used for power supply is made in its own factory. The raw material is collected from Germany and China. People can easily purchase the panels and products from the company's wholesaler or Non Government Organization (NGO)'s who purchase product from them. AVA Renewable Energy Ltd. is always concerned about the service to customers.



## Chapter 4: Methodology

### 4.1 Type of Research

This study is a descriptive research, as it has a problem statement. The research included both qualitative and quantitative analyses. The purpose of qualitative research was to identify various attributes and attribute-levels of solar energy. Quantitative analysis has been done to measure the importance of each attribute and suggest the best profile of different attribute levels for commercially launching AVA solar panels in Bangladesh.

For qualitative research, secondary data have been analyzed to identify the attributes and levels of solar panels. For quantitative research, survey has been conducted of 48 people who are the head of their family. They were asked about their age, monthly income, use of solar panel, monthly expense, etc. The attributes and levels found are shown in the following table:

Attributes	Level 1	Level 2	Level 3	Level 4
Capacity	50 w	100 w	150 w	200 w
Installment	12 months	24 months	36months	
Price	500-1000 tk	1000-1500 tk	1500-2000 tk	

**Table 4: Attributes and Levels for AVA solar**

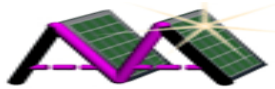
### 4.2 Target Population and Sampling Frame

AVA solar is a solar energy provider. In this study, target population is defined as those who face load shedding in daily lives and who are looking for alternative solution. From those, sampling frame included middle and upper class people of Rangpur district.

### 4.3 Sample size

For any analysis to be normally distributed, at least 30 samples are needed. For conducting this study, total 48 samples were interviewed. The final sample size is calculated by following formula:

$$Total\_Sample = \frac{Initial\_Sample}{Incidence\_Rate \times Completion\_Rate}$$



$$\begin{aligned} &= \frac{40}{0.90 \times 0.90} \\ &= 47.82 \approx 48 \text{ (rounded to the nearest decimal)} \end{aligned}$$

#### **4.4 Sources of Data**

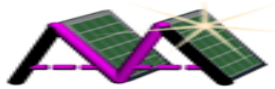
This study is based entirely on primary data. No study has been conducted before regarding AVA solar. At first, secondary research has been conducted to identify variables, attributes, and levels for the final product. Based on those attribute-levels, primary data is collected through survey from people using structured questionnaire.

#### **4.5 Questionnaire Design and Pretest**

There are several questionnaires used in this study. The information required for secondary research is not a formal one, but included all the aspects to identify the attributes necessary in the final product. The survey questionnaire used to collect primary data was a combination of MCQ, and dichotomous questions. Other than this, full profiles of attribute-levels were included. The respondents were asked to rate each profile in a 100-points scale. After data collection, the profiles were ranked based on the rating given by the respondents. Only a few demographic questions were set. The major focus was on the consumption of solar panels. A sample questionnaire is given as Appendix A1.

#### **4.6 Data Analyzing Tools**

The resultant data is analyzed by using Conjoint Analysis procedure. It has been found from secondary research that capacity, installment, and price are the major attributes that influence the selection of AVA solar panels. The software package used in this study is SPSS 16. The analytical table was modified taking those into MS Excel 2007. Once the questionnaire was prepared, a database was created using SPSS 16 software. After the data collection, data has been entered and analysis has been done.



## Chapter 5: Data analysis

### 5.1 Identifying Attribute-Levels for AVA Solar

To analyze the data, conjoint analysis is conducted in this study. The conjoint analysis follows formal process starting from problem formulation that ends at reliability assessment. In this study, the attributes and its levels are selected from the secondary research. They are shown in the table below:

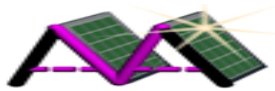
AVA SOLAR – ATTRIBUTES AND LEVELS		
Attributes	Level No.	Description
Capacity	1	50 w
	2	100 w
	3	150 w
	4	200 w
Installment	1	12 months
	2	24 months
	3	36 months
Price	1	500 – 1000Tk
	2	1000 - 1500Tk
	3	1500 - 2000Tk

**Table 5: Attribute Name, Number, and Levels**

From the table above, full profiles were constructed by combining all the attributes and levels.

The probable number of profiles =  $4 \times 3 \times 3$   
=36

The number of profiles has been decreased by using *fractional factorial design*. Thus, the number of profiles becomes 16, as given in the questionnaire in the appendix. In each of the



profiles, the respondents have put their ratings in a 100-points scale. This rating gives the data in an interval scale resulting in metric data.

The basic conjoint model is used to measure the utility of each combination of attributes and levels. The model may be represented by following formula:

$$U(X) = \sum_{i=1}^m \sum_{j=1}^{k_i} \alpha_{ij} X_{ij}$$

Where.  $U(X)$  = Utility of the variable

$\alpha$  = Significance level

$X$  = Dummy variable

$i$  = Attribute of the variable.

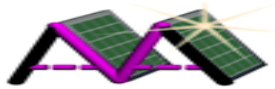
$j$  = Level of the variable.

There are many procedures available for estimating this model. The simplest way is dummy variable regression. In doing this, the variables are needed to be converted into dummy variables.

The following table shows dummy variables for the attributes.

<b>AVA Solar – Data Coded for Dummy Variable Regression</b>						
<b>Capacity</b>			<b>Installment</b>		<b>Price</b>	
X1	X2	X3	X4	X5	X6	X7
1	0	0	0	1	0	1
0	0	1	0	1	0	0
1	0	0	0	1	1	0
1	0	0	0	0	0	0
0	0	1	0	0	0	1
0	0	1	1	0	1	0
0	0	0	1	0	0	1





0	1	0	0	0	0	0
0	0	0	0	0	1	0
0	0	0	0	0	0	0
0	0	0	0	1	0	0
0	1	0	0	0	0	1
0	1	0	1	0	0	0
0	0	1	0	0	0	0
1	0	0	0	0	1	0
1	0	0	1	0	0	0

**Table 6: Dummy Variable for AVA solar**

The model can be represented as:

$$U = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7$$

Where,  $X_1, X_2, X_3$  = Dummy variable representing Capacity

$X_4, X_5$  = Dummy variable representing Installment

$X_6, X_7$  = Dummy variable representing Price

$b$  = Parameters

By doing regression analysis, the parameters are estimated as follows:

$$b_0 = 62.898 \qquad b_3 = -14.250 \qquad b_6 = -.802$$

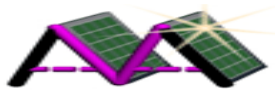
$$b_1 = 11.156 \qquad b_4 = -.974 \qquad b_7 = -3.661$$

$$b_2 = 8.464 \qquad b_5 = -2.490$$

These parameters are helpful in estimating the utility of each attribute-level. The detailed calculation is given below:

**1) For Capacity,**

$$\alpha_{11} - \alpha_{14} = 11.156 \dots\dots\dots(i)$$



$$\acute{\alpha}_{12} - \acute{\alpha}_{14} = 8.464 \dots \dots \dots \text{(ii)}$$

$$\acute{\alpha}_{13} - \acute{\alpha}_{14} = -14.250 \dots \dots \dots \text{(iii)}$$

$$\acute{\alpha}_{11} + \acute{\alpha}_{12} + \acute{\alpha}_{13} + \acute{\alpha}_{14} = 0 \dots \dots \dots \text{(iv)}$$

**Solution:**

From (i)

$$\acute{\alpha}_{11} - \acute{\alpha}_{14} = 11.156$$

$$\therefore \acute{\alpha}_{11} = 11.156 + \acute{\alpha}_{14}$$

From (ii)

$$\acute{\alpha}_{12} - \acute{\alpha}_{14} = 8.464$$

$$\therefore \acute{\alpha}_{12} = 8.464 + \acute{\alpha}_{14}$$

From (iii)

$$\acute{\alpha}_{13} - \acute{\alpha}_{14} = -14.250$$

$$\therefore \acute{\alpha}_{13} = \acute{\alpha}_{14} - 14.250$$

Put into (iv)

$$11.156 + \acute{\alpha}_{14} + 8.464 + \acute{\alpha}_{14} + \acute{\alpha}_{14} - 14.250 + \acute{\alpha}_{14} = 0$$

$$\Rightarrow 5.34 + 4 \acute{\alpha}_{14} = 0$$

$$\Rightarrow 4 \acute{\alpha}_{14} = -5.37$$

$$\therefore \acute{\alpha}_{14} = -1.34$$

Put into (i)

$$\acute{\alpha}_{11} + 1.34 = 11.156$$

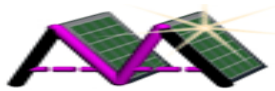
$$\therefore \acute{\alpha}_{11} = 9.81$$

Put into (ii)

$$\acute{\alpha}_{12} + 1.34 = 8.464$$

$$\therefore \acute{\alpha}_{12} = 7.12$$

Put into (iii)



$$\acute{\alpha}_{13} + 1.34 = -14.250$$

$$\therefore \acute{\alpha}_{13} = -15.59$$

**2) For Installment,**

$$\acute{\alpha}_{21} - \acute{\alpha}_{23} = -.974 \dots \dots \dots (i)$$

$$\acute{\alpha}_{22} - \acute{\alpha}_{23} = -2.490 \dots \dots \dots (ii)$$

$$\acute{\alpha}_{21} + \acute{\alpha}_{22} + \acute{\alpha}_{23} = 0 \dots \dots \dots (iii)$$

**Solution:**

From (i)

$$\acute{\alpha}_{21} - \acute{\alpha}_{23} = -.974$$

$$\therefore \acute{\alpha}_{21} = \acute{\alpha}_{23} - .974$$

From (ii)

$$\acute{\alpha}_{22} - \acute{\alpha}_{23} = -2.490$$

$$\therefore \acute{\alpha}_{22} = \acute{\alpha}_{23} - 2.49$$

Put into (iii)

$$\acute{\alpha}_{23} - .974 + \acute{\alpha}_{23} - 2.49 + \acute{\alpha}_{23} = 0$$

$$\Rightarrow 3\acute{\alpha}_{23} - 3.464 = 0$$

$$\therefore \acute{\alpha}_{23} = 1.154$$

Put into (i)

$$\acute{\alpha}_{21} - 1.154 = -.974$$

$$\therefore \acute{\alpha}_{21} = 0.18$$

Put into (ii)

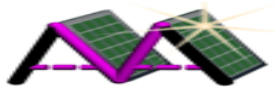
$$\acute{\alpha}_{22} - 1.154 = -2.490$$

$$\acute{\alpha}_{22} = -1.336$$

**3) For Price,**

$$\acute{\alpha}_{31} - \acute{\alpha}_{33} = -.802 \dots \dots \dots (i)$$

$$\acute{\alpha}_{32} - \acute{\alpha}_{33} = -3.661 \dots \dots \dots (ii)$$



$$\alpha_{31} + \alpha_{32} + \alpha_{33} = 0 \dots \dots \dots (iii)$$

**Solution:**

From (i)

$$\begin{aligned} \alpha_{31} - \alpha_{33} &= -.802 \\ \therefore \alpha_{31} &= \alpha_{33} -.802 \end{aligned}$$

From (ii)

$$\begin{aligned} \alpha_{32} - \alpha_{33} &= -3.661 \\ \therefore \alpha_{32} &= \alpha_{33} -3.661 \end{aligned}$$

Put into (iii)

$$\begin{aligned} \alpha_{33} -.802 + \alpha_{33} -3.661 + \alpha_{33} &= 0 \\ \Rightarrow 3 \alpha_{33} -4.463 &= 0 \\ \therefore \alpha_{33} &= 1.49 \end{aligned}$$

Put into (i)

$$\begin{aligned} \alpha_{31} -1.49 &= -.802 \\ \therefore \alpha_{31} &= 0.69 \end{aligned}$$

Put into (ii)

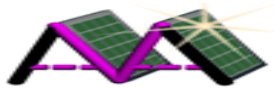
$$\begin{aligned} \alpha_{32} - 1.49 &= -3.661 \\ \therefore \alpha_{32} &= -2.17 \end{aligned}$$

**5.2 Ranges of Part-Worth Utility:**

The range of part-worth utility for each of the attributes is calculated by maximum utility minus minimum utility for each of the levels. It can be shown as the following equation:

$$I_j = \{ \max(\alpha_{ij}) - \min(\alpha_{ij}) \}$$

$$\begin{aligned} \text{For Capacity} &= \alpha_{\max} - \alpha_{\min} \\ &= 9.81 - (-15.59) \\ &= 25.4 \end{aligned}$$



$$\begin{aligned} \text{For Installment} &= \hat{\alpha}_{\max} - \hat{\alpha}_{\min} \\ &= 1.154 - (-1.336) \\ &= 2.49 \end{aligned}$$

$$\begin{aligned} \text{For Price} &= \hat{\alpha}_{\max} - \hat{\alpha}_{\min} \\ &= 1.49 - (-2.17) \\ &= 3.66 \end{aligned}$$

### 5.3 Relative Importance:

The relative importance of each attribute-level is the ratio of the range of the part-worth utility to the total importance of the attributes. Thus, the relative importance weight is calculated below:

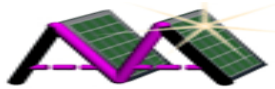
$$\begin{aligned} \text{For Capacity} &= \text{Range of Part-Worth Utility} / \text{Total Importance} \\ &= 25.4 / 31.55 \\ &= 0.805 \end{aligned}$$

$$\begin{aligned} \text{For Installment} &= 2.49 / 31.55 \\ &= 0.0789 \end{aligned}$$

$$\begin{aligned} \text{For Price} &= 3.66 / 31.55 \\ &= 0.116 \end{aligned}$$

The final outcome can be shown in the following table:

<b>Result of Conjoint Analysis</b>				
<b>Attribute</b>	<b>Level</b>	<b>Utility</b>	<b>Range of Part-Worth Utility</b>	<b>Relative Importance</b>
<b>Capacity</b>	100 w[ $\hat{\alpha}_{11}$ ]	9.81	25.4	0.805
	150 w [ $\hat{\alpha}_{12}$ ]	7.12		
	200 w [ $\hat{\alpha}_{13}$ ]	-15.59		

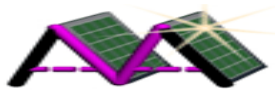


	50 w [ $\alpha_{14}$ ]	-1.34		
<b>Installment</b>	24 months [ $\alpha_{21}$ ]	0.18	2.49	0.0789
	36 months [ $\alpha_{22}$ ]	-1.336		
	12 months [ $\alpha_{23}$ ]	1.154		
<b>Price</b>	500-1000 tk [ $\alpha_{31}$ ]	0.69	3.66	0.116
	1000-1500 tk [ $\alpha_{32}$ ]	-2.17		
	1500-2000 tk [ $\alpha_{33}$ ]	1.49		
		<b>Total</b>	<b>31.55</b>	

**Table 7: Outcome of Conjoint Analysis**

From the table above, it can be said that –

- People’s demand for 100 w is higher.
- People refer 12 installments to pay the price.
- People are ready to spend BDT 1500-2000 per installment.



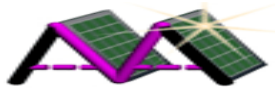
## **Chapter 6: Findings and Discussion**

Among 48 respondents, 41 were male and 7 were female. Monthly incomes of interviewed people are mostly within BDT 20000 to 40000. Only a few numbers of people earn more than BDT 60000. Most duration of load shedding was more than 2 hours. 15 households had no electricity at all. Among 48 people, 19 people used candle or other sources at the time of load shedding. 16 people used IPS and 13 people used solar panels. 36 people spend less than BDT 100 at the time of load shedding using substitute sources and only 1 person spend BDT 500 to 1000 in it. It is alarming that 31 people knew about solar panel and 17 people did not. Among the people who know about solar panel, only 15 people use it and 33 did not. All the relevant tables, figures, and diagrams are given in the Appendix A2 to A4.

<b>Reasons</b>	<b>Frequency</b>	<b>Percent</b>
Do not know about solar panel	5	10.4
House owner does not permit	6	12.5
More expensive	9	18.8
Do not how it works	4	8.3
May change residential area	1	2.1
Cannot supply enough energy	8	16.7
Total	33	68.8

**Table 8: Reason of not using**

The table shows that, among 48 respondents, 5 respondents do not know about solar panel. 6 respondents' house owner does not permit to install solar panel. 9 thought solar panel is more expensive. 4 do not know how it works. 1 person may change his residential area and 8 thought solar panel is unable to supply enough energy. The table also shows, 18.8% people do not use solar panel because they thought it is more expensive and 2.1% person can change their residential area.



## **Chapter 7: Recommendations and Conclusion**

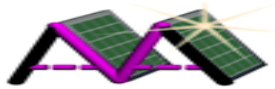
### **7.1: Recommendations:**

- AVA Renewable Energy Ltd. has various packages. They should develop their 100w package because people demand of this package is high.
- AVA Renewable Energy Ltd. should give more advertisement in different media like Radio, TV, Newspaper, and Magazine depending the target market.
- AVA Renewable Energy Ltd. should launch solar products using its name because it already gained a positive feedback from its panel.
- AVA Renewable Energy Ltd. should develop a customer care help line number so that the customer or other people can get help 24 hours.
- AVA Renewable Energy Ltd. needs to develop marketing and management system, like strong branding, recruit sufficient marketer in marketing department etc.
- Although AVA Renewable Energy Ltd. has skilled project supervisor, there has shortage of man power. They should increase the number of man power while completing a project.
- AVA Renewable Energy Ltd. should provide a home service system so that the customer can get better service.
- AVA Renewable Energy Ltd. should provide loan and other financial facilities for the lower-middle and lower income clients to increase the sale.

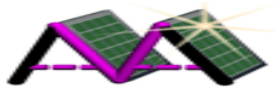
### **7.2: Conclusion**

Today renewable solar energy is recognized in the world as the main engine that runs the economy. The demand of energy is very high, particularly in Dhaka and other major cities. So, the prospect of solar business is very high. Now if the solar companies run their business according to the demand of middle class, lower middle class, and higher middle class people, the business must be profitable. The number of population all over the world is increasing day by day whereas the supply of energy is not increasing in the competition with the increasing people. Solar energy has become a good source of power supply all over the world. Bangladesh is also





doing better in this sector. From the study, which I have conducted at AVA Renewable Energy Ltd. found that they are using all the possible policies to run the business. The report also has shown the overall picture of the solar market and opportunity in Bangladesh. If the company works more in expanding the business, it will get good result. Working with AVA Renewable Energy Ltd, I found some lacking related to the company that is discussed as recommendation.



## **References**

AVA SOLAR (2014) *About AVA*. [Online] Available from: <http://www.avasolarbd.com/about-AREL.html> [Accessed: 30 October 2014]

DOUGLAS, A., WILLIUM, G. & SAMUEL, A., (2009) *Statistical Techniques in Business and Economics*: 12<sup>th</sup> edition. Mc GRAW-HILL.

GOOGLE (2014) *Probability and statistics symbols table*. [Online] Available from: [http://www.rapidtables.com/math/symbols/Statistical\\_Symbols.htm](http://www.rapidtables.com/math/symbols/Statistical_Symbols.htm) [Accessed: 30 October 2014]

MALHOTRA, K. (2011) *Marketing Research*. Prentice Hall.

WIKI PEDIA (2014) *Solar Energy*. [Online] Available from: [http://en.wikipedia.org/wiki/Solar\\_energy](http://en.wikipedia.org/wiki/Solar_energy) [Accessed: 30 October 2014]

## Appendices

### Questionnaire regarding Solar Energy

Name: \_\_\_\_\_

Gender: 1. Male      2. Female

Age: \_\_\_\_\_yrs

Monthly Income:      1. Less than 20000

                                    2. 20000 to 40000

                                    3. 40000 to 60000

                                    4. More than 60000

Residential Area: \_\_\_\_\_

Duration of Load Shedding (Daily on Average): \_\_\_\_\_ hours

What do you use at the time of load shedding?

1. IPS      2. Generator      3. Solar      4. Other sources

How much do you spend in it (monthly)?

1. Less than BDT 100                      2. BDT 100 to BDT 500

3. BDT 500 to BDT 1000                      4. More than BDT 1000

Do you know about Solar Panel?      1. Yes      2. No

Do you use Solar Panel during Load-Shedding?      1. Yes      2. No

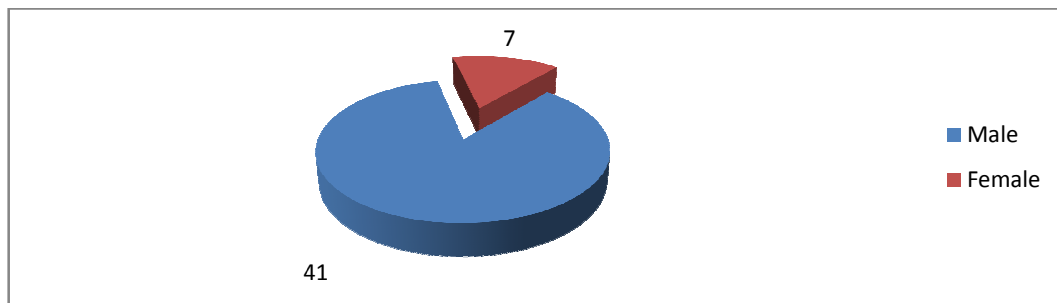
If NO, why do you not use Solar Panel?

- 1) I do not know about Solar Panel
- 2) House owner does not permit
- 3) I think it more expensive
- 4) I do not know how it works
- 5) I may change residential area
- 6) It cannot supply enough energy capacity
- 7) Others \_\_\_\_\_

Following are a list of different package of Solar Energy that can be offered in the market. Please consider each of the 16 profiles and put a rating at 100 points scale. Remember that you cannot put the same rating on two profiles.

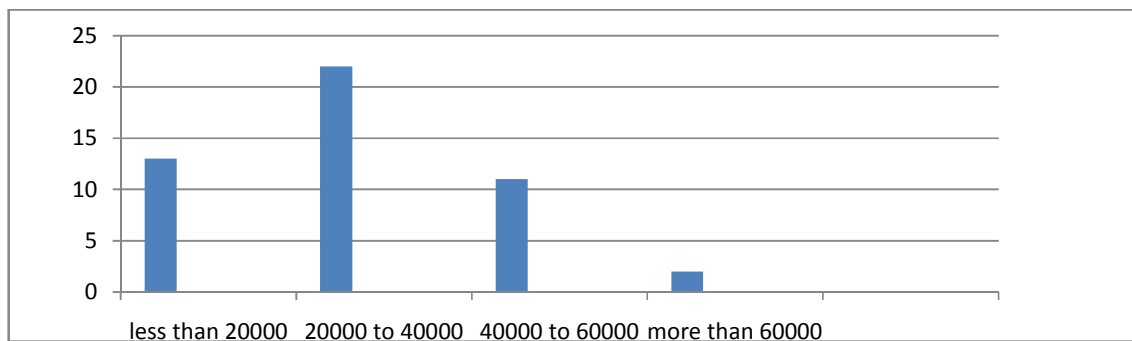
Profile no.	Capacity	Installment	Price per installment	Rate (out of 100)
1	100 w	36 months	1500-2000	
2	200 w	36 months	500-1000	
3	150 w	36 months	1000-1500	
4	100 w	12 months	500-1000	
5	200 w	12 months	1500-2000	
6	200 w	24 months	1000-1500	
7	50 w	24 months	1500-2000	
8	150 w	12 months	500-1000	
9	50 w	12 months	1000-1500	
10	50 w	12 months	500-1000	
11	50 w	36 months	500-1000	
12	150 w	12 months	1500-2000	
13	150 w	24 months	500-1000	
14	200 w	12 months	500-1000	
15	100 w	12 months	1000-1500	
16	100 w	24 months	500-1000	

**Pie chart for Gender**



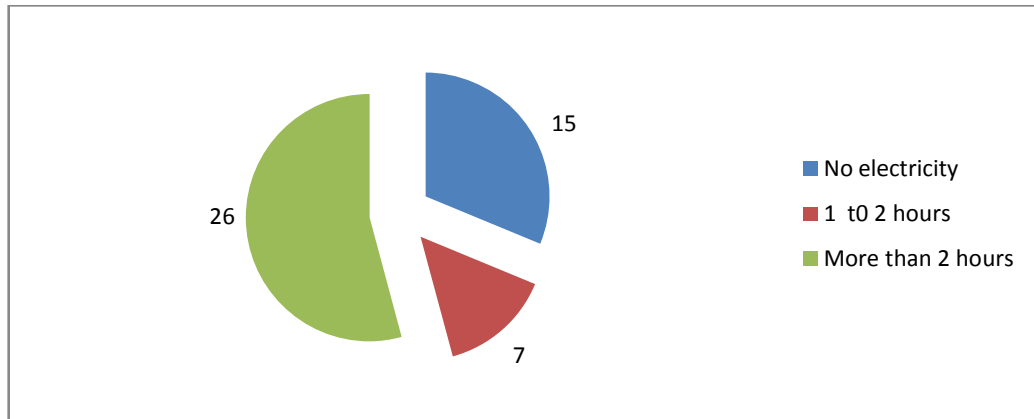
**Figure 3: Gender**

**Bar chart for Monthly Income**



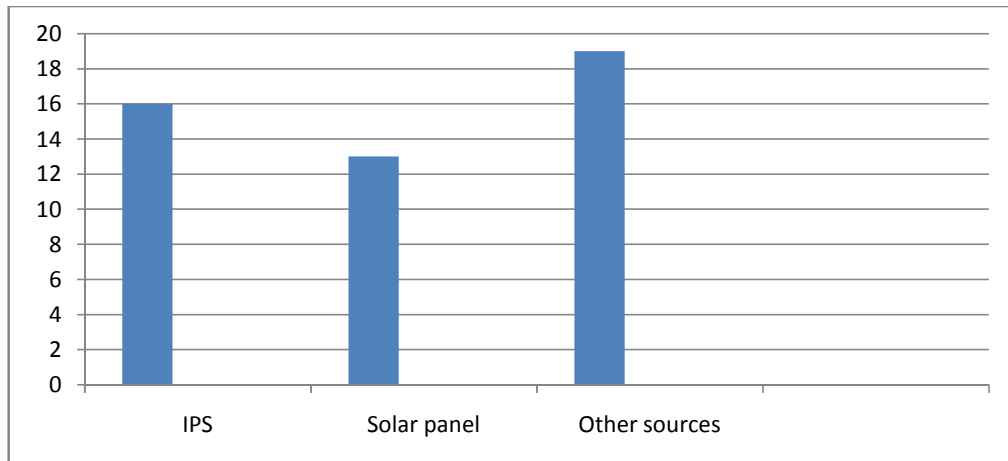
**Figure 4: Monthly Income**

**Pie chart for Load Shedding Duration**



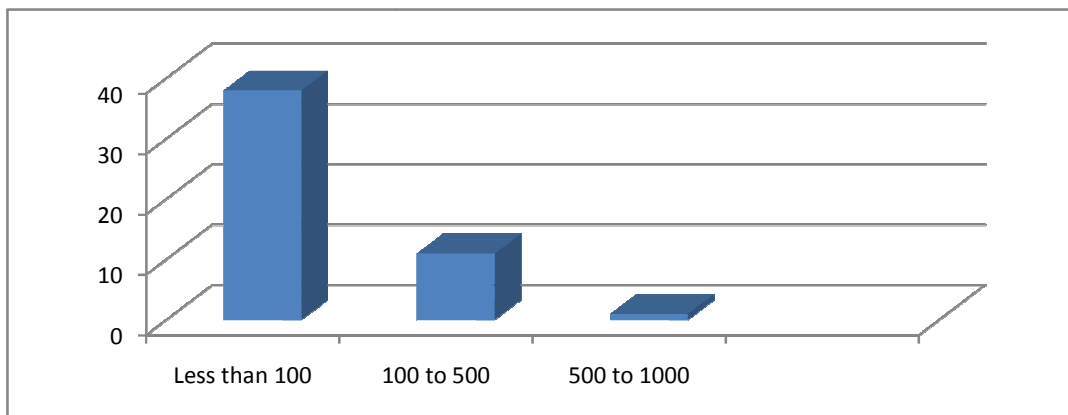
**Figure 5: Load Shedding**

**Bar chart for Substitute of Load Shedding**



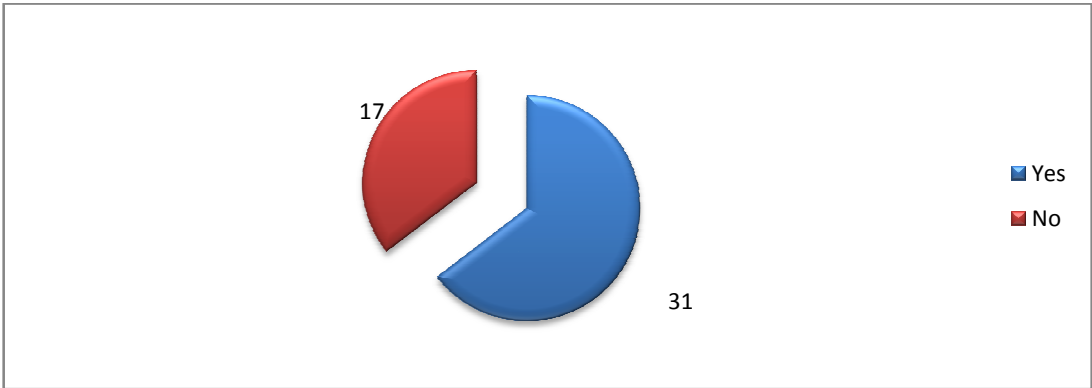
**Figure 6: Substitute of Load Shedding**

**Bar chart for Monthly Expenditure**



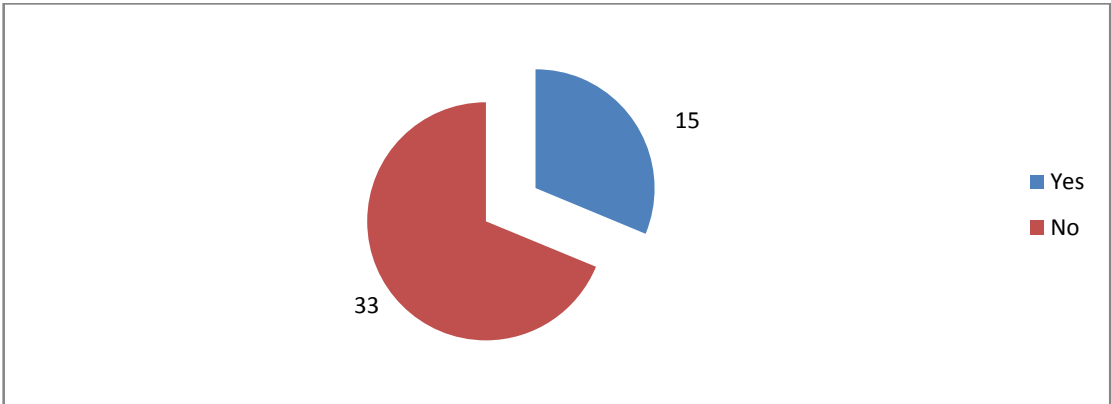
**Figure 7: Monthly Expenditure**

**Pie chart for Awareness of Solar Panel**



**Figure 8: Awareness of Solar Panel**

**Pie chart for Use of Solar Panel**



**Figure 9: Use of Solar Panel**