CHAPTER IV

RESEARCH

METHODOLOGY
CHAPTER - 4
4. RESEARCH METHODOLOGY

4.1 Introduction
Adaptability of Consumer more studied and referred subject of consumer behavior. To understand consumer psychology and its adaptability need to do more research on topic. It is process of deciding whether select or reject product is called adaptability. As invention of bulb by Thomas Edison there are more invention happened in energy sector. As we all are habitual of using conventional energy source we are using it. But as problems are there like energy cuts, load shading, shortage of energy we started adaptability of non-conventional energy sources to overcome these problems.
The purpose of this study understands the consumer adaptability process in-depth in and around Pune city. What, when, where, How Consumer adapt the Non-Conventional energy source.
This topic covers the research methodology used to test hypothesis derived and satisfy the objective of the study. The research plan includes sampling design, data collection sources and methods, questionnaire design. Finally, Statistical techniques used for data analysis such as exploratory research analysis, percentage analysis, factor analysis, chi-square test are discussed.

4.2 Statement of the Research Problem
This study arises from the need of understand the consume adaptability about non-conventional source of energy as compared to conventional regular source of energy. Its energy saving and finding alternative source of energy for Conventional Energy source. As a consumer are always quality, quantity and price conscious they always want product with best possible solutions with best 4 P’s. The need of Energy/Electricity Saving and finding alternative source of energy for Conventional Energy source.
As a problems have increased in Urban and Rural India. I.e. Load Shading and Light cut off. It is very necessary that to study awareness created by Non- Conventional Energy Source in India. It is alternative source for the Conventional Energy Source.
The rapid growth of Industry, increase in environmental variability and acute shortage of electricity and the corresponding increase in need of electricity and Increasing costs of Electricity and increasing environment pollution. To find out the best possible and suitable
alternative as non-Conventional and conventional energy Source. To research the cost effective and pollution-free and inexhaustible source. How It save time, money and energy. Understanding the various Government subsidy Schemes on Non-Conventional Energy Sources for Consumers, for they are unaware and need to focus and create awareness about it. To know how it helps to generate entrepreneurship and employment opportunity in rural and urban India. To investigate or find out how it helps to solve energy problem and conserve energy for Industry, Society and Nation like in India.

4.3 Objectives of the Research:-
Research Objectives as Follows

Objective 1

Objective 2

Objective 3
To Study Extent of Awareness on Household Energy Efficiency Improvement.

Objective 4
To Study Direct and Indirect Employment/ Entrepreneur Opportunities Especially Created by Non-Conventional Energy Sources in Rural and Backward Areas.

Objective 5
To Study the Energy Option as Green and Environment Helpful Option.

Objective 6
To Study the Awareness about State and Central Government Subsidy Schemes of Non-Conventional Energy Source Schemes, and making their utilization and Adaptability to Consumers.
4.4 Hypothesis:-

The Research Hypothesis as follows

**Hypothesis 1**

“Most of the consumers are aware of Non-Conventional source of energy.”

**Hypothesis 2**

“Selection of Proper & appropriate Non-Conventional energy source is up to the Awareness of Consumer.”

**Hypothesis 3**

“Consumer having knowledge of Non-Conventional energy source have started Adaptability of the Non-Conventional source of energy.”

**Hypothesis 4**

“Consumers have knowledge about government subsidies for Non-Conventional Energy Source.”

**Hypothesis 5**

“Consumers those have knowledge of Government subsidies are taking benefit of government Subsidies.”

4.5 Scope of the Study

As explained above study focus on two type of Consumers

1. Corporate Consumers and
2. Household Consumers

Researcher basically study adaptability of Household and Corporate Consumers.

Geographical Scope of the study is confined to Pune in and around for the both type of Household and Corporate Consumers.

All major areas/ parts of Pune City, newly constructed apartments, newly based townships and few Thasils and villages within Pune district including Warje, Narhe, Malawadi, Shindewadi, Pirangut, Nanded city, Sanghavi, Wakad, Urali Kanchan, Talegaon Dhabahade, Sudumbare, Chikali, Bhosari, Nigadi, Sadasiv Peth, Deccan, Shivaji Nagar, Kothrud, Karve Nagar, Camp, Aundh, Sanghvi, Baramati, lonavala, and many more places……
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Parameter</th>
<th>Pune</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total Population</td>
<td>94,29,959</td>
</tr>
<tr>
<td>2</td>
<td>Rural Population</td>
<td>36,78,226</td>
</tr>
<tr>
<td>3</td>
<td>Urban Population</td>
<td>57,51,733</td>
</tr>
<tr>
<td>4</td>
<td>Thasils</td>
<td>14</td>
</tr>
<tr>
<td>5</td>
<td>No. of Villages</td>
<td>1912</td>
</tr>
<tr>
<td>6</td>
<td>Principal Source of Energy</td>
<td>MSEB Power Grid/ Solar Energy</td>
</tr>
<tr>
<td>7</td>
<td>Indian installed capacity of the energy source.</td>
<td>2,500MW</td>
</tr>
</tbody>
</table>

India Census Study 2011 and TERI Report.

**4.6 Types of Research**

This is Descriptive type of Research which contains analyses and investigative enquires of various types. The major purpose of the research is the description of the facts, observations.

**4.7 Sampling Design**

The researcher thus follows the following procedure of research

**Sampling Method**

Researcher used Simple Random (Purposive) Sampling.

**Sampling Element**

There are two types of Sampling elements being studied namely corporate and Household Consumer.

Sampling has been carried out by researcher to concentrate upon a well segmented number of Consumers and hence devote more energy. The information collected from them is accurate and technique used for the sampling is Simple Random Sampling Technique (Purposive Sampling). In this technique proportionate allocation pattern has been used where a sampling
fraction in each of the sample that is proportional to that of the total respondents who have mainly the Household Consumer and Corporate Consumer.

There are large numbers of consumer in and around Pune city who are using Conventional Source of Energy. Many of them are using conventional and Non-Conventional Source of Energy. As Compared to Conventional Source of Energy users Non-Conventional Energy Source User are quite less in number.

In this research work, the Sample size is 400 out of those 200 corporate consumers and 200 household consumers.

All major areas/ parts of City, newly constructed apartments, newly based townships and few Thasils and villages within Pune district including Warje, Narhe, Malawadi, Shindewadi, Pirangut, Nanded city, Sanghavi, Wakad, Urani Kanchan, Talegaon Dhabahade, Sudumbare, Chikali, Bhosari, Nigadi, Sadashiv Peth, Deccan, Shivaji Nagar, Kothrud, Karve Nagar, Camp, Aundh, Sanghvi, Baramati, lonavala, and many more places…..

Sample Size:--

Researcher has surveyed 400 consumers in that 200 household and 200 corporate consumers in and around Pune city. Which includes Students, Housewives, Businessmen’s, Government employee, Doctors, retired person, travel agent, Private Company employees, Government officers, consumers other occupation also.

Sample Size Calculation:--

Research Design

Different types of research designs have different advantages and disadvantages. The design is the structure of any scientific work. It gives direction and systematizes the research. The methods we choose affect our results and how we conclude the findings. Most scientists are interested in getting reliable observations that can help the understanding of a phenomenon.
Since this piece of research has study available large number of consumers for using the conventional and non-conventional energy sources. For study purposed used Exploratory Research Design.

**Survey of adaptability of consumer’s:-**

**Universe**

All consumers who are using solar energy source in and around Pune city.

**Sampling Technique**

Simple Random Sampling technique is used because the whole Pune population was taken into consideration for the survey. Researcher conducted the survey of consumers who are using conventional and non-conventional source of energy for the study in and around Pune city.

**4.8 Sources and Methods of Data Collection**

After preparing the details of the information required, the investigation will be done and the main tools of collecting the information will be as worked out as follows.

a) Secondary data:-

Journals, brouchers, internet sites etc.

Newspaper articles, Media, Reports, Publications

Primary information collected from websites and company broachers
MITCON, Chamber of commerce offices were visited to get more information

b) Primary data: -

i) Questionnaire:- It is the list of research or survey questions asked to respondents, and designed to extract specific information. It serves four basic purposes: to (a) collect the appropriate data, (b) make data comparable and amenable to analysis, (c) minimize bias in formulating and asking question, and (d) to make questions engaging and varied.
ii) Personal Interview: - It is a Market research technique for gathering information through face-to-face contact with individuals. This type of research is relatively costly, because it requires a staff of interviewers, but it provides the best opportunity to obtain information through probing for clearer explanations. The personal style (tone of voice, rewording of a question) and biases of each interviewer can affect how the participants respond and how the responses are recorded. It is the best technique to use early on in the research process when the researcher is not yet sure which questions need to be asked, because new and better questions can come out of the dialogue.

iii) Observation: - Observation Method is method of obtaining marketing research data by watching human behavior & mechanical monitoring devices closely are also used commonly. Observation is a complex research method because it often requires the researcher to play a number of roles and to use a number of techniques; including her/his five senses, to collect data. In addition, despite the level of involvement with the study group, the researcher must always remember her/his primary role as a researcher and remain detached enough to collect and analyze data relevant to the problem under investigation.

Visits will be made to various places where conventional and Non-Conventional energy source are using by Consumer. Contacted approximately more than 400 consumers who are using conventional and Non-conventional energy sources. To get detail information from them and filling up questionnaire, interview and live observation; this helped to gather reliable information regarding subject of the survey.

4.9 Design of Questionnaire

The Researcher has used two different questionnaires for the collection of primary data from two types of sample respondents. First questionnaire is used for corporate consumers and second one is household consumer.

1. Corporate Consumer
2. Household Consumer

This questionnaire contains two major sections

1. Demographic Profile of Consumers
2. Consumer adaptability for Energy Sources

**Questionnaire 1st For Corporate Consumers:** - Adaptability of consumer for non-conventional source of energy as compared conventional regular source of energy in and around Pune city.
This questionnaire was designed to collect the primary data from the respondents who are adaptable for non-conventional source of energy as a compared to conventional regular source of energy in and around Pune city. This was a structured questionnaire with close ended, Dichotomous (multiple choice), Importance, Bipolar, Likert, Rating Scale 1-5, Adaptability Propensity questions to avoid the variations in the responses of the consumers. All questions were given sufficient options to record the replies or the consumers. This style of questionnaire was adapted to standardize the responses. All the questions are formulated on the based on comprehensive literature review, expert’s opinions and pilot survey. After explain the reason of the review and gaining approval, the consumers asked to fill questionnaire. In common, major consumer willing to help in the study survey and their adaptability towards non-conventional source of the energy.

The questionnaire contains two major sections such as-

Section – I Consumers Demographic Profile

Section – II Adaptability of Consumers

The logic rationales behind formulation of respective questions are as follows-

**Question No. 1 to 6** were based on the demographic characteristics of the respondents. In these questions were asked to record Name, Gender, Age, Educational Qualification, Occupation and Monthly Family Income of the consumers.

**Question No. 7 to 9** It’s regarding average monthly usage of electricity to understand monthly usage. In these questions were asked regarding consumer awareness and adaptability of non-conventional source of energy.

**Question No. 10 to 15** were designed to know the consumers usage of energy sources, Types of conventional source of energy and usage, to understanding rating experience of conventional for urban rural electrification and best option for urban and rural electrification. To study the employment opportunity created by conventional energy source in urban, rural and backward areas.

**Question No. 16 to 18** were designed to know the usage of conventional energy source, average monthly billing of electricity, Satisfaction of average monthly billing capacity usage.

**Question No. 19 to 27** were designed to know the non-conventional energy source its usage, its regarding solar equipment and its usage. To understand different strategies adopted for solar energy adoption. Rating experience of household energy efficiency improvement. Solar energy is green and environment friendly option. To study the switching of consumers from conventional source to non-conventional source of energy. To study the employment opportunity created by conventional energy source in urban, rural and backward areas. To
create awareness created by state and central government subsidy schemes for the solar energy.

**Question No. 28 to 30** were designed to know the stages of adoption process and level of the adoption categories. To know the factors keeps impacts on solar energy adoption.

**Question No. 31 to 35** were designed to know the marketing decision of solar energy adoption and its influence due to solar as ample energy. Option utilization by government for solar adoption. Experience sharing and rating of solar energy adoption. List of Company for solar energy equipment manufacturing, use and utilization.

**Questionnaire 2nd For Household Consumers:** - Adaptability of consumer for non-conventional source of energy as compared conventional regular source of energy in and around Pune city.

This questionnaire was designed to collect the primary data from the respondents who are adaptable for non-conventional source of energy as a compared to conventional regular source of energy in and around Pune city. This was a structured questionnaire with close ended, Dichotomous (multiple choice), Importance, Bipolar, Likert, Rating Scale 1-5, Adaptability Propensity questions to avoid the variations in the responses of the consumers. All questions were given sufficient options to record the replies or the consumers. This style of questionnaire was adapted to standardize the responses. All the questions are formulated on the based on comprehensive literature review, expert’s opinions and pilot survey.

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### 4.10 Mapping of Questionnaire with Objectives

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Questionnaire I
Q.10
Section I & II
Questionnaire 2
Q. 7

Questionnaire I Q 9
Section I & II
Questionnaire 6

Consumer Adaptability
Objective 1

Consumer Adaptability
Awareness
Objective 2
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4.11 Pilot Study
A Pilot study was conducted covering 40 respondents for evaluating the consumer opinion regarding their adaptability for non-conventional source of energy as compared to conventional regular source of energy. Based on the pilot study, the questionnaire was suitable restructured wherever required and used for collecting requisite information to meet objective of the study.

4.12 Reliability Analysis of Questionnaire
“Majority of study Reliability used to evaluate the amount of reliability among several dimensions of Variables. Finding the internal reliability between objects is the common dimension of consistency”, explained by Copper and Schielder, 2006. By the view of the Churchill, (1979) Cronbach ’s alpha it is majorly used to measure to find out the test internal consistency and is reflected satisfactory if it exceeds .06 Churchill he records the reason of the consistency, the coefficient alpha need to calculated prior to any extra data analysis.

The study uses Cronbach’s alpha to measure the internal reliability of the questionnaire with statistical software SPSS 21, this research tested the reliability of the measuring scale for 50 items. As shown in table below Cronbach’s α (alpha) .904

<table>
<thead>
<tr>
<th>Number of Items</th>
<th>Cronbach’s α (Alpha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>.806</td>
</tr>
</tbody>
</table>

“Reliability over .80 is respectable consistency near the value of .70 is satisfactory and consistency less than .60 is measured unfortunate”, Sekaran, 2003 and according Guieford 1965 suggestion, when cronbach’s alpha is greater than .7 it shows the questionnaire has a relative high internal reliability.

The result of the study show that Cronbach’s α (alpha) .806 is higher than .7 It indicates that the reliability of the questionnaire is acceptable. Taking the reliability test, it can be known that this research is reliable and it can be used in the verification of hypothetical study.

The researcher’s archives reliability and credibility by conducting a number of discussions with academic and commercial specialties in the researched context. This provided the researcher’s with useful guidance and avoided the researcher’s failure in addressing key research themes.
4.13 Analysis of the Data

After the data have been collected a number of closely related operations such as establishment of categories, the application of these categories to raw data through coding and tabulation are done and then statistical inferences are drawn.

A collected data was in discrete categorical form hence simple percentile analysis of the data was done. The various variables are analyzed based on their frequency of occurrence. Since, Cross tabulation analysis, also known as contingency table analysis is most often used to analyses categorical (nominal measurement scale) data. Researcher has applied it to understand the association and relationship between the respective variables.

The **Chi Square Test** is thought to be appropriate to test the hypothesis as the data was in discrete categorical form. The Chi-square test is an important test amongst the several tests of the significance developed by statistician. It is basically used when the sample size is large. Chi-square symbolically written as $\chi^2$ is a statistical measure used in the context of sampling analysis for comparing the variance to a theoretical variance. The test is in fact a technique through the use of which it is possible for the researcher to test the significance of association between two variables.

**Factor Analysis**

“It is a multivariate statistical method whose primary purpose is to define a structure within a set of observed variables”, Stewart 1981. Due to the unknown nature of the data structure in this study exploratory factor analysis is adopted.

“To make it suitable, the concern of the research is projected, or the minimum number of features is needed to account for the maximum portion of the variance”, hair et al, 2006.

“Bartlett’s Test of Sphericity is used as the statistical technique to test the appropriateness in the correlation matrix. This test provides the statistical probability that the correlation matrix has significant correlations among the variables”.

“Kaiser Meryer Olkin measure of sampling adequacy (MSA) intends to quantify the degree of interrelations among the variables and the appropriateness of factor analysis. The index ranges from 0 to 1, reaching 1 when each variable is perfectly predicted without error by the other variables”, Hair et al., 2006. Kaiser and Rice, 1974 “summarized different levels of MSA as .90 marvelous; .80 Meritorious .70 middling, .60 mediocre .50 miserable and below .50 unacceptable.”
“The Screen test is used to identify the optimum number of factors and is applied by plotting the latent roots against the number of factors in their order of extraction, the shape of the resulting curve can determine the cut-off point”, Hair et al, 2006. The procedure is summarized by Stewart 1981 as “A straight edge is laid across the bottom portion of the roots to see where they form an approximately straight line. The point where the factors curve above the straight line gives the number of factors, the last factor being the one whose eigenvalue immediately precedes the straight line.”

“A Varimax Rotation method is applied to variables. The selected factors were based on Eigen values equal to or greater than 1.00. In this research, the chosen cut off point. For significance loading is minimum 0.50. Then factors and selected items were grouped and renamed accordingly. Factors analysis was performed on twenty one items representing reasons of dissatisfaction of customers contributing in switching decision and five factors were extracted”.

4.14 Use of Computer Software in Data Analysis

1. SPSS 17.0 update version (Statistical package for the Social Science) was used for the data analysis.

2. Microsoft Office Excel 2010 is used to generate graphs based on frequency distribution tables.

4.15 Limitations of the Study

In this research I have prepared questionnaire for the corporate consumer and household consumer only it’s taken in to consideration only in and around Pune city. Only Pune in and around area geography is limitation. Corporate customer number is very less. As a solar energy source is used by only limited corporate consumer and household consumers so limitation is there. As most of the household consumers are using only Solar Water heater so there is no scope for the other solar products. The most of corporate consumer are using only primary MSEB energy source they are not using solar energy source. Because for solar energy required cost for Solar Photovoltaic cell and cost of inverter battery is very high most of the clients are not thinking to install it. In this case cost is very important factor.
Most of the consumer having lack of knowledge regarding government subsidy schemes for solar photovoltaic cell, even they are unaware about exemption of VAT and GST. Adoption as most of the consumer is habitual of MSEB they do not want to invest on Solar Energy Source.

4.16 Time Horizon

Another important characteristic of the present research process is the time horizon. The present dissertation has a cross sectional time horizon as it is recognized to be appropriate to the research aim and the researcher’s resources.

This research has been conducted in the period of the year 2011 to 2015. However the primary data was collected through questionnaire from July 2013 to June 2016.