Energy Efficient Products and Indian Consumers

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Published by

CUTS International

D-217, Bhaskar Marg, Bani Park
Jaipur 302016, India
Tel: +91.141.2282821, Fax: +91.141.2282485
Email: cuts@cuts.org
Website: www.cuts-international.org

ClimateWorks FOUNDATION

SHAKTI SUSTAINABLE ENERGY FOUNDATION

First published: March 2012

This paper has been produced with the financial assistance of ClimateWorks Foundation, US through Shakti Sustainable Foundation, New Delhi under the project entitled, 'Assessing Consumer Behavour on Energy Efficient Products in India'. The views expressed here are those of the commentators/authors and can therefore in no way be taken to reflect the positions of Shakti Sustainable Foundation, New Delhi and ClimateWorks Foundation, US

ISBN: 978-81-8257-164-8

Printed in India by Jaipur Printers Private Limited, Jaipur

#1204

Contents

List of Annexures, Tables, Boxes and Figures

Annexures

Tables

Boxes

Figures

Acronyms

ARRA	American Recovery and Reinvestment Act
ASEAN	Association of Southeast Asian Nations
BEE	Bureau of Energy Efficiency
CEAMA	Consumer Electronics and Appliances Manufacturers Association
CEE	Consortium of Energy Efficiency
CFC	Chlorofluorocarbon
CII	Confederation of Indian Industry
DoCA	Department of Consumer Affairs
DSM	Demand Side Management
EC	European Community
EE	Energy Efficient
EPA	Environmental Protection Agency
FICCI	Federation of Indian Chambers of Commerce and Industry
GDP	Gross Domestic Product
GHGs	Greenhouse Gases
IEEJ	The Institute of Energy Economics, Japan

LDCs	Least Developed Countries
MEPS	Minimum Energy Performance Standards
NETP	National Educational and Training Programme
NPC	National Petroleum Council
NRDC	National Research Development Corporation
NYSERDA	The New York State Energy Research and Development Authority
OECD	Organisation for Economic Cooperation and Development
S&L	Standards and Labelling
UTs	Union Territories
WTP	Willingness to Pay

Foreword

Energy efficiency is rapidly becoming a key policy tool all over the world in order to meet the substantial growth in demand for energy services. According to the IEA, 71 percent of the global emissions reductions would come from energy efficiency improvements in 2020 and 38 percent by 2050. A key component of the mitigation potential of energy efficiency is being realised by policies designed to encourage the purchase of energy efficient appliances and equipment.

India's energy security is critical to maintaining its high growth rate. Currently India faces a peak power capacity shortage of about 9.8 percent, and approximately 8.5 percent of its total electricity demand is left un-served. Standards & Labelling (S&L) for appliances and equipments is one of the major programme areas for improving energy efficiency and bridging the gap between demand and supply of energy in India. This report "Assessing Consumer Behaviour on Energy Efficient Products in India" reveals the impact of the S&L programme during the last few years.

The report also reflects that with increased number of appliances under S&L programme, and with increased consumer awareness, there exists a huge potential for energy savings which can be achieved in near future. It may be pertinent to note the S&L programme alone has reported savings over 7000 MW during the 11th Plan period.

However, there are several barriers to uptake of energy efficient appliances, including low consumer awareness and

high upfront cost of energy efficient appliances. This report assesses current consumer awareness and use patterns of energy efficient appliances, and attempt to provide a strategic basis for the continuous promotion of energy efficiency and conservation in India.

I am sure that energy efficiency community would find this report very useful, and that it would facilitate the process for further engagement of consumers in energy efficiency programmes by increased promotion and outreach.

Ajay Mathur, PhD
Director General
Bureau of Energy Efficiency
(Government of India, Ministry of Power)

Prologue

If we want to be energy secure in times of depleting resources, we need to be as concerned about its outflow as about inflow. India has a population of over a billion which means that its consumption potential is huge. By the same yardstick, if a billion people get together they can save a very significant amount of energy.

Efficiency is the most economical way in which India can invest in its energy security and growth. Given our already critical energy situation, we need to urgently catalyse saving at the mass level; especially because the Indian consumer base is increasing rapidly.

In principle this should not be a difficult task; Indians typically are not given to wasting. However, switching off a bulb not in use, while welcome, will not result in savings of any scale. For that, consumers will have to migrate to more efficient appliances and manufacturers will have to make them. Cost is an issue on either side; such appliances are expensive to make and therefore to buy.

One will have to work on the market landscape to bring about this change. Needless to say, the perceptions of consumers, retailers and appliance manufacturers around the cost issues of efficient appliances inevitably inform the design and implementation of efficiency measures, and will need to be addressed.

This Shakti-supported project carried out by Consumer Unity & Trust Society (CUTS), in partnership with Nielsen,

is a step in this direction. The study spread over 19 states and three union territories, is the first-ever large scale effort to understand the energy-efficient appliances market.

It does throw up new facts while strengthening old assumptions – for example consumers are actually not as averse to energy-efficient appliances as is often touted. However, it is true that aversion is linked to higher costs and that consumers have not yet comprehended the quantum of saving possible as a result of the initial higher investment.

This is a study that will help all of us. I thank CUTS and the Nielsen for undertaking this important study; the insights will go a long way in informing the collective effort in the energy efficiency space.

Seema Paul
Chief Executive Officer
Shakti Sustainable Energy Foundation

Preface

Economic growth is critically dependent on availability and accessibility of energy. Its sustainability is dependent on sustainability of energy supply, among other important factors. This holds true for every country.

At the current rate of economic growth the demand for energy is expected to increase significantly. Meeting this increasing demand will require availability of and accessibility to energy on a sustained basis. The task is challenging considering the fact that most of the energy sources are finite and, more importantly, it requires significant technological advancement, capital investment, etc.

Even if one considers that during the medium term (covering the next two decades) there will be better availability of hydrocarbons, many other vital constraints will be encountered to produce sufficient energy to meet the increasing demand. Some of the most important constraints will be carbon-dioxide emission standards, limitations on research and development expenditure, increasing capital requirements, etc.

India is expected to face a huge challenge in sustaining its high economic growth during the coming years. And a prime factor will be supply constraint in the energy sector. At present, India imports about 70 percent of its oil requirements which is expected to go up to 80 percent over the next five years. Import of coal, an important and relatively cheaper source of energy, is also expected to go up to 30 percent (from 10 percent at present).

Anecdotal evidence suggests that there is now a growing tendency to link price of coal with the price of oil. It is also important to note that almost 40 percent of the Indian population has no or very little access to electrical energy. Supply constraints on the one hand and growing need for energy on the other could result in a huge mismatch between demand and supply. There is, thus, a clear need for ensuring more energy supply if India is to achieve the projected 9 percent growth during the 12th Five Year Plan period of 2012-17.

Promotion of energy efficiency is to be looked at from this perspective. Demand and supply of energy are to be managed simultaneously. This, in turn, requires a holistic approach, addressing production as well as the consumption side of the equation. Understanding demand side factors, especially among households, is crucial in this respect as this sector accounts for more than 20 percent of total energy consumption in India. This is expected to grow as more and more households get access to electrical energy. This calls for better understanding of consumer behaviour on energy usage. Such understanding can undoubtedly help in promoting energy efficiency through policy and practice changes.

Consumers should be aware about the benefits of using energy efficient products. Such awareness and concomitant consumer behaviour is a crucial determinant of the demand-side management of energy. In order to better understand consumer behaviour, it is critical for the policy makers to have a comprehensive understanding of existing consumption patterns, their trends, future market for energy efficient products (taking into account changing income levels and changes in consumer preferences), factors that influence consumption habits, information channels that influence purchase decisions, etc.

This is the rationale behind our project entitled "Assessing Consumer Behaviour on Energy Efficient Products in India".

A systematic understanding of consumer behaviour on energy efficient products and their benefits as well as the determination of the level of and trends in the use of these products is lacking in India. Our study has come out with a benchmark against which future development on awareness about the need for energy conservation and use of energy efficient products can be evaluated and further actions can be planned accordingly.

In short, this report provides a basis for designing future strategies for enhancing the use of energy efficient products in India. It analyses consumer behaviour on energy efficient products, presents their perception on various issues relating to energy efficiency, and draws from international good practices.

It is based on a survey of more than 20,000 households covering 19 major states and three union territories. Moreover, a number of traders and manufacturers of energy efficient electrical appliances were surveyed to understand supply-side factors. A total of 76 districts and 19 state capitals were covered.

Our study has clearly shown that in recent years the Standards and Labelling Programme of the Bureau of Energy Efficiency has made significant progress. Consumer awareness on the use of energy efficient products is increasing. Their willingness to know more about energy efficiency and also to pay a premium is also on the rise. These have contributed significantly to the penetration of energy efficient products.

Another important observation that has emerged is a good number of consumers have shown an inclination to shift to energy efficient products. This shift, though, will depend on market dynamics. The study underlines that there are some limitations and threats such as high up-front cost, a significant number of consumers being indifferent or lowly satisfied, and their willingness to pay is limited to about 10 percent over

and above the price of non-energy efficient products. These call for focused initiatives and interventions at consumer, producer as well as at the retail level.

Our report is a result of team effort and contributions made by various colleagues and organisations. We thank all those who have been associated with this project in different capacities. In particular, we express our gratitude to The ClimateWorks Foundation, USA and the Shakti Sustainable Energy Foundation, India for their support.

We thank Chandramouli Guin, Tanu Kak and Mousumi Dutta of Nielsen for their diligent handing of the survey work. Our compliments to Palak Chadha, Manbar Khadka, Reena Purohit and Anutosh Biswas of CUTS International for the adroit implementation. We acknowledge the contribution of Ravi Tewari, Madhuri Vasnani and Mukesh Tyagi of CUTS International in publishing this study and to Arun Talwar, G C Jain and L N Sharma for financial management of the project.

Finally, our special thanks to Dr. Ajay Mathur, Director General, Bureau of Energy Efficiency for his support. We look forward to work together for a more sustainable and low-carbon growth of our country.

Pradeep S. Mehta
Secretary General
CUTS International

Executive Summary

Energy efficiency in home appliances is now emerging as a useful tool in addressing the issue of energy security. A large number of countries – both developed and developing – have already introduced the programme and many others are expected to follow suit. The success of such consumer-oriented programmes is critically dependent on awareness and acceptability of energy efficient products by consumers. To ensure efficient use of energy, through usage of energy efficient (EE) products, India launched its Standards and Labelling (S&L) Programme in 2006.

The present report, commissioned to assess consumer awareness and use of energy-efficient home appliances in India, is based on primary information collected from consumers based on their perception. Primary information has also been collected from traders and producers of home appliances. Secondary sources and data have also been used to supplement information gathered from the primary sources. An attempt has also been made to review India's existing pattern of demand and supply of energy from different sources and the widening gap.

The report clearly explains the widening gap between demand and supply of energy in India and the need for energy efficiency (EE) and conservation. India needs to increase its energy supply by at least 20 percent to bridge this growing demand-supply gap. It also discusses how energy efficiency can help India to reduce, if not bridge, this gap completely.

Generating consumer awareness and making EE products more affordable to consumers are identified to be two major ways of realising increased market penetration of these products.

The study finds that S&L programme has made significant progress over the last few years. Awareness of consumers about EE products appears to be more impressive than ever, though lack of data makes it difficult to compare.

The report also reveals that the willingness of consumers to know more about energy efficiency and also pay premium is on the rise. These improvements in the market have resulted in significant increase in the penetration of EE products. The result is evidenced by energy saving resulting from the use of EE home appliances. Total energy saving is estimated at over 2170 MW.

What is more important is that these savings have been realised from only eight EE products. This is reflective of its huge potential. One can expect that with increase in number of products supported by increased awareness and products' affordability, its ingrained potential can be achieved.

The study also reveals that some positive developments are also taking place on the supply side – producers and traders. A good number of them surveyed under the present study show their willingness to gradually, but steadily, shift to EE products in the coming period. This shift, however, will be also dependent on market dynamics.

One of the important findings from the survey is, among positive developments, that there also exist some limitations and threats to the programme. Firstly, consumer awareness, though having grown impressively, is yet to reach a critical mass. A significant percentage of consumers are yet to know about energy efficiency and its associated benefits. Secondly, considering that the market price of EE products is significantly higher than price of traditional products, their demand can be adversely affected by price. Data reveal that, of the total

consumers who are willing to pay premium for EE products, more than 70 percent of them showed their willingness to pay in the range of only up to 10 percent.

The study reveals that product features such as energy efficiency do not yet attract consumers. It is found to be a laggard compared to other motivating factors such as products' brand and model. Product-wise data on motivating factors that influence consumer demand for electrical/electronic appliances demonstrate that consumers give little weightage to energy efficiency. The weightage given varies from one product to another.

The study also reveals that a significant number of users (over 22 percent) indicated they are either not satisfied or lowly satisfied from the use of energy efficient products (Table 43). One important reason for the low level of satisfaction from use of energy efficient products can be that the usage has not resulted in a decline in the electricity bill. Lack of satisfaction of this segment of consumers could make them vulnerable in the times to come, if appropriate steps are not taken to address their concern.

Though existing literature indicates that high prices and unavailability are two barriers, but findings from the survey also demonstrate that little knowledge of operation of energy-efficient appliances also forms a major barrier for 21 percent of the households.

The weaknesses emerging from consumers' perception is reinforced by traders' perception on what consumer values most while making purchase decisions. Nearly one-third of traders are of the view that product's upfront cost is a major determinant which influences consumer's purchase decisions. Similar observations can be made from the type of problems faced by producers. This can prove to be a real deterrent to energy efficiency drive.

Based on perceptions of consumers, traders and producers, the study also reveals how these limitations and threats can be overcome. These will require three specific measures. More than two-third consumers are of the opinion that reduction in cost/price and/or subsidisation of EE products can significantly contribute to removal of these barriers. There is also need for outreach programmes on operational issues focusing on consumers and traders. These initiatives, however, need to go hand in hand with initiatives for increasing awareness. The issue, however, looks very complex, as it requires active engagement and cooperation of various stakeholders.

The report consists of Seven Chapters. The First Chapter briefly outlines the objectives of the study and the project methodology. Chapter Two deals with evolution of energy efficiency and its need in the emerging global energy dynamics, with special reference to India.

Progress made in promotion of energy-efficient products is discussed in Chapter Three. Chapter Four reviews producers' and consumers' responses to S&L programmes around the world, with special reference to India.

The findings from the field survey covering consumers, traders and producers' awareness and inclination towards energy efficiency are presented in Chapter Five.

In Chapter Six, the potential approach to make energy efficient products more useful and acceptable to Indian consumers is discussed.

Chapter Seven concludes and provides recommendations for making energy efficiency a way of life for consumers in India. Chapters are followed by Annexures and References in the report.

Chapter 1
About the Project

Why this Project?

Economic activities and growth in India and also South Asia are now critically dependent on the availability and accessibility of energy from exhaustible (conventional sources of energy) and/or non-exhaustible or renewable sources. India has, over the last two decades, made rapid progress towards energy-based mechanisation of economic activities in both rural and urban areas. India (along with China) now leads the world's energy demand growth and the country for its energy requirement is critically dependent on fossil fuels.

Considering the current usage pattern of fossil fuels and the exhaustible energy sources, the availability of such sources is not guaranteed in the long-run. On the other hand, the development of renewable sources of energy is considered to be at its nascent stage and is yet to reach a level where it can guarantee a sustained economic growth. Given such circumstances, the sustainability of economic growth is jeopardised.

Thus, there is a growing realisation among various stakeholders that India will find it increasingly difficult to sustain its economic growth in the coming period. To counter this issue, there is greater need to develop and mainstream

both alternative energy sources and energy efficiency into India's growth process.

There are two ways to promote energy efficiency in India:

- Promotion of energy efficient products; and
- Adoption of energy efficient technologies.

Both are challenging, as they involve a number of diverse stakeholders, such as policy makers, manufacturers and, more importantly, consumers with varying consumption habits and preferences. At the same time, there is need to understand the ground situation of sustainability of both demand and supply of energy efficient products. And, for understanding this, one requires a benchmark on various aspects of demand and supply of energy-efficient products.

For the enhancement of energy efficiency in the country as a whole, there has to be a simultaneous increase in the production and consumption of energy-efficient products. Importantly, consumers need to be aware of the benefits of purchasing energy-efficient products, both from economic and environmental perspectives. Such awareness and concomitant consumer behaviour is a crucial determinant of the use of energy-efficient products.

As the subject is complex, it is critical for the stakeholders, especially the policy makers, to have a comprehensive understanding of existing production and consumption patterns; consumption trend; future market for such products (based on changing income levels and change in consumption habits and preferences); factors that influence consumption habits; information channels that influence purchase decisions, among others.

In India, attempts to evolve a systematic understanding of consumer behaviour on energy-efficient products and their benefits as well as the determination of the level of and secular trends in use of these products have been lacking. There is, thus, an urgent need to gauge consumer behaviour in regard to these products.

This project, entitled "Assessing Consumer Behaviour on Energy Efficient Products in India" (CONBEE), is expected to generate a comprehensive benchmark against which future developments in awareness about the need for energy conservation and use of energy-efficient products can be evaluated. It will provide a basis for designing future strategies for enhancing the use of energy-efficient products in India.

It will address the above mentioned issues by analysing consumer behaviour of energy efficient products, estimating future demand for energy efficient products, understanding supply-side constraints (including a critical look at fiscal and monetary incentives to manufacturers and traders) and drawing from international good practices and understanding their relevance in the Indian context, by juxtaposing them in the regulatory environmental framework in the country.

Project Objective

The project objective is to provide a strategic basis for the promotion of energy efficiency and conservation in India by correctly characterising the present status of the following aspects:

- Stakeholders' awareness and the need for energy conservation;
- Use of energy-efficient products; and
- Determinants of such usage, including barriers to the purchase of such products.

Methodology

The project has two components. The first one is a comprehensive desk research based on secondary sources such as existing literature and the second one is field research based on primary sources such as field data.

Desk Research

Desk research includes the following information collated from books, journals, newspapers, magazine articles and online sources:

- Results of past studies on consumer awareness about energy conservation in India which show the extent of such awareness and the willingness of consumers to pay for energy-efficient products in various functional categories such as lighting, air conditioning and cooling, cooking, cleaning etc. Results that show how such awareness is influenced by income, geographical location, rural urban divide, and other socio-economic factors;
- Results of studies which document the actual level of use of energy-efficient appliances in the various mentioned functional categories and how such awareness is influenced by the mentioned factors. Results that show the actual price premiums associated with such use relative to that of traditional products characterised by lower levels of energy efficiency;
- Producer and trader awareness about consumer behaviour and perceptions with regard to the above-mentioned areas; and
- Analysis of sociological, political and economic barriers which restrict either awareness about the need for energy conservation or the actual use of energy-efficient products.

Field Research

Formulation of Survey Questionnaires and Creation of Data Template

The objective is to derive a comprehensive and updated picture of the status of awareness about energy conservation and use of energy-efficient appliances. The survey intends to

ascertain consumer awareness about *Energy Star Label* of the *Bureau of Energy Efficiency* and the significance of such awareness among consumers.

Three variants of the questionnaire were developed for the purpose: the first one for households, the second one for producers and the third one for traders. Each variant attempts to get similar information on consumer behaviour and perceptions on the need for energy conservation and greater use of energy-efficient products.

The three sets of questionnaires were finalised taking into account the comments made by experts in the project inception meeting (held on April 12, 2011) and in consultation with the surveying agency (*Nielsen*). Based on the finalised questionnaires, data templates were created for data entry. The survey and related activities were conducted during the months of May to September 2011.

Sample Size

A total of 20,166 household consumers, 50 producers and 550 traders were surveyed for data analysis. The survey covered 19 states[1] and three union territories (UTs). Four districts – covering eastern, western, northern and southern parts[2] – in each of the selected states, along with the state capitals, have been selected. In total, the survey covers 76 districts and 19 state capitals. Besides, three Union Territories – Chandigarh, Delhi and Pondicherry – have also been covered.

Specific methodologies followed in sample distribution for each of the segments are delineated below. More details on how the sample size of consumers, traders and producers is distributed across states and UTs are shown in Annexure 1.1.

Consumer Survey

A stratified random sampling procedure was followed to make the household sample representative of the Indian

population. A sub-sample of households was drawn from 19 of the total Indian states and three of the union territories (UTs) with the percentage share of each sub-sample in the overall sample being equal to the state's/UT's share in the total population of selected states/UTs. For example, if a state has a share of 16 percent in the total population, its share in the sample is 16 percent.

In case of identifying sample districts in each of the state, a more rigorous methodology was followed. The selection was based on districts' Composite Index,[3] which covers 13 socio-economic and demographic indicators. One important feature of this index is that it includes electricity as one of the components.

The state districts were arranged in order of their rank and then segregated on a regional basis – east, west, north, and south. One district from each of the region was selected. To have a proper understanding of the state, districts with middle-most Index value from each region was selected.

The sub-sample drawn from each state/UT was made not only geographically representative but also structured to reflect the gender mix, income distribution and population shares of rural and urban areas in that state/UT.

Within each district, a city (town) and four/five villages, as geographically dispersed as possible, were chosen for sampling procedure. The share of the urban (rural) component in the sub-sub sample is equal to the share of the urban (rural) population in the total state population.

Trader Survey

The sample size for traders was 500 and, as in the case of consumers, was spread over 19 states and 3 UTs. Since trading in electrical appliances is critically dependent on availability and accessibility of electrical energy, the methodology followed in sample distribution was slightly different in this case. Gross

electric consumption of each state was considered as an important indicator of use of electrical appliances. The distribution, therefore, was based on the share of each of the selected states in the aggregated electricity consumption of those states. For example, if the share of a state in total electricity consumption is 18 percent, its share in the sample size is 18 percent.

At the district level, there is lack of data or inconsistency in data on electricity consumption, among other issues. Therefore, districts identified for the consumers' survey have been retained for traders also and the distribution follows a similar methodology as in the case of consumers. The sample size for a district is based on the district share in the total population of the selected districts.

Information from business associations and lists of traders sourced from yellow pages of important urban centres are used to build an inventory of traders in energy-efficient products. The zonal composition of the inventory (share of each zone – North, South, East and West – in the total number of traders included) is reflected in the sample drawn of traders.

Producer Survey

Producer survey had a sample size of 50 producers. The sample was drawn from a nationwide inventory of producers based on information from business associations such as the Consumer Electronics and Appliances Manufacturers Association (CEAMA), the Federation of the Indian Chambers of Commerce and Industry (FICCI), the Confederation of Indian Industries (CII), etc.

Such inventorisation was also used to collate information on the total turnover, geographical location, etc. Purposive sampling has been undertaken so that the sample of 50 producers is not only geographically representative but also provides balanced representation of big and small producers.

Data Analysis and Report Writing

The data collected was analysed using statistical methods. The results of the data analysis were combined with those emerging from the literature review and dialogues with stakeholders, including policy makers, to draft the project report. It is expected to provide insights into the following:

- Secular trends about consumer awareness on energy conservation, use and purchase of energy-efficient appliances and consumers' willingness to pay for such appliances;
- Cultural, social and political barriers to use of energy-efficient appliances and, thus, energy conservation; and
- Options in terms of policy and practice that can be used to promote such energy conservation.

Structure of the Report

The report is divided into Seven Chapters. Chapter 2 deals with evolution of energy efficiency and its need in the world, with special reference to India. It sheds light upon the need for integrating energy efficiency policy with India's economic growth strategy.

Chapter 3 assesses the progress made in promotion of energy-efficient products in India. It analyses Standards and Labelling (S&L) Programmes in India. It assesses the effectiveness and changing demand patterns for energy-efficient products based on consumers' awareness and their environmental consciousness; legal and regulatory energy efficiency framework in India; and barriers to efficient usage of energy-efficient products.

Chapter 4 reviews producer and consumer responses to S&L programmes around the world, with special reference to India. The review focuses on assessing producer behaviour in the context of energy efficiency (profit maximisation, subject to cost constraint); and consumer behaviour with regard to

income constraint and changing price levels. It further shows how such awareness is influenced by income, geographical location and rural-urban divide. It also covers international good practices on energy efficiency and major lessons that India can learn from such practices.

Chapter 5 presents the findings of the survey covering consumer, trader and producer awareness and their inclination towards energy efficiency. It sheds light upon the level of awareness about energy-efficient products in India; usage patterns of energy-efficient products and factors that determine usage patterns; barriers to both awareness generation and usage of energy efficient products; channels that can be more effective in popularising the energy efficiency concept; consumers' willingness to pay for energy-efficient appliances; producers'/traders' behaviour and factors determining production and sale of such products. It also covers the demand trend and supply-side constraints of energy-efficient products.

Chapter 6 deals with the potential approach to make energy efficient products more useful and acceptable to consumers in India. It identifies demand and supply-side constraints, stakeholders' roles in promoting the use of energy-efficient products in India and the expected impact of price and income variation on producer and consumer welfare. It also elucidates the changes needed in policy and regulatory framework and the scope for further penetration of energy-efficient products in India.

Chapter 7 concludes with recommendations for making energy efficiency a way of life for consumers in India. Chapters are followed by references and annexures in the report.

Annexure 1.1: Sample Distribution by State and Districts				
State/Districts/ UTs	**Consumers**			**Traders**
	Sample Size	***Rural***	***Urban***	***Sample Size***
Andhara Pradesh				
Hyderabad	343	0	343	10
East Godavari	454	372	82	14
Medak	248	203	45	7
Nizamabad	218	179	39	6
Nellore	248	203	45	7
Total	**1511**	**957**	**554**	**44**
Assam				
Kamrup	178	0	178	3
Karbi Anglong	57	50	7	1
Dhubri	115	100	15	2
Nalbari	80	70	10	2
Cachar	102	89	13	2
Total	**532**	**309**	**223**	**10**
Bihar				
Patna	542	0	542	3
Purnia	292	257	35	2
Gopalganj	247	217	30	2
Madhepura	175	154	21	1
Gaya	399	351	48	3
Total	**1655**	**979**	**676**	**11**
Chhattisgarh				
Raipur	159	0	159	4
Mahasamund	46	37	9	2
Rajnandgaon	68	54	14	2
Surguja	104	83	21	3
Dantewada	38	30	8	1
Total	**415**	**204**	**211**	**12**
Gujarat				
Ahmadabad	494	0	494	25
Narmada	44	28	16	3
Jamnagar	163	103	60	8
Patan	101	64	37	5

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Junagadh	208	131	77	11
Total	**1010**	**326**	**684**	**52**
Haryana				
Jhajjar	72	0	72	3
Karnal	103	72	31	5
Bhiwani	115	81	34	5
Fatehabad	65	46	19	3
Mahendragarh	66	46	20	3
Total	**421**	**245**	**176**	**19**
Himachal Pradesh				
Shimla	29	0	29	4
Lahul & Spiti	16	12	4	1
Kangra	54	43	11	7
Chamba	20	16	4	3
Sirmaur	20	16	4	3
Total	**139**	**87**	**52**	**18**
Jharkhand				
Ranchi	167	0	167	6
Dumka	105	89	16	4
Gumla	81	69	12	3
Godda	63	54	9	2
Pashchimi Singhbhum	125	106	19	4
Total	**541**	**318**	**223**	**19**
Karnataka				
Bangalore	413	0	413	12
Chitradurga	96	63	33	3
Belgaum	266	176	90	8
Bijapur	115	76	39	3
Mysore	166	110	56	5
Total	**1056**	**425**	**631**	**31**
Kerala				
Thiruvananthapuram	167	0	167	4
Palakkad	135	100	35	3
Ernakulam	160	118	42	4
Wayanad	41	30	11	1
Kollam	133	98	35	3
Total	**636**	**346**	**290**	**15**

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Madhya Pradesh				
Bhopal	318	0	318	7
Rewa	341	249	92	8
Mandsaur	205	150	55	5
Sheopur	97	71	26	2
Balaghat	250	183	67	6
Total	**1211**	**653**	**558**	**28**
Maharashtra				
Mumbai	336	0	336	13
Latur	210	122	88	8
Pune	730	424	306	27
Jalgaon	372	216	156	14
Satara	283	164	119	11
Total	**1931**	**926**	**1005**	**73**
Orissa				
Cuttack	235	0	235	6
Kendrapara	131	106	25	3
Kalahandi	134	109	25	3
Sundargarh	184	149	35	4
Gajapati	52	42	10	2
Total	**736**	**406**	**330**	**18**
Punjab				
Ludhiana	151	100	51	8
Rupnagar	55	36	19	3
Firozpur	87	57	30	6
Amritsar	153	101	52	8
Muktsar	39	26	13	3
Total	**485**	**320**	**165**	**28**
Rajasthan				
Jaipur	493	0	493	11
Sawai Madhopur	105	81	24	4
Barmer	184	142	42	4
Jhunjhunun	180	139	41	4
Chittaurgarh	169	130	39	4
Total	**1131**	**492**	**639**	**27**
Tamil Nadu				
Chennai	460	0	460	18
Thiruvarur	127	84	43	5

Contd...

The Nilgiris	83	55	28	3
Vellore	379	250	129	15
Virudhunagar	191	126	65	7
Total	**1240**	**515**	**725**	**48**
Uttarakhand				
Bageshwar	17	12	5	1
Dehradun	87	63	24	5
Pithoragarh	31	22	9	2
Uttarkashi	20	14	6	1
Champawat	15	11	4	1
Total	**170**	**122**	**48**	**10**
Uttar Pradesh				
Lucknow	784	0	784	10
Ghazipur	650	507	143	8
Aligarh	637	497	140	8
Moradabad	799	623	176	10
Mirzapur	450	351	99	6
Total	**3320**	**1978**	**1342**	**42**
West Bengal				
Kolkata	338	0	338	5
Dakshin Dinajpur	112	80	32	2
Puruliya	187	133	54	3
Jalpaiguri	251	178	73	4
Medinipur	712	506	206	11
Total	**1600**	**897**	**703**	**25**
U.Ts.				
Chandigarh	20	**2**		
Delhi	275	**20**		
Pondicherry	20	**2**		

Chapter 2
Evolution of Energy Efficiency and Its Need

Definition of Energy Efficiency

World Energy Council defines[4] energy efficiency (EE) as all changes that result in reduction in the energy used for a given energy service or level of activity. This reduction in the energy use, however, may not necessarily be associated with technical changes, as it can also result from a better organisation and management or improved economic efficiency in the sector resulting in overall gains of productivity. There are also other definitions of energy efficiency.

To some, energy efficiency is simply the process of doing more with less. Its primary goal is to accomplish the same tasks and functions as before while using less energy.[5]

In other words, it implies having a more efficient way of using energy which enables users to keep the same comfort while consuming less energy.[6] Energy efficiency enhances the scope for sustained use of energy and is based on three elements which are by order of importance:

1. Reduce energy demand as much as possible,
2. Use renewable sources of energy, and
3. Use fossil energy as efficiently as possible and only if sustainable sources are inadequate.

Energy efficiency, overall, can said to be a matter of individual conscience and is reflected by the rationale of consumer behaviour.

Generally, the issue of energy efficiency arises when there is a challenge to sustainable supply of a product or service for one or more reasons, such as shortage in inputs, increases in cost of production and capital requirement, change in technology, impact of existing product or technology on the environment, etc.

On the demand side, easy affordability and accessibility and impact of existing products on the environment also influence initiatives for energy efficiency. The issue gets further highlighted when there is a sign of consistently increasing demand/consumption (or at least no decline) and its proven adverse impacts on the environment.

Origin of Energy Efficiency

Energy efficiency is not a new concept. It has, in fact, existed for quite a long period. It is believed that the first mandatory standards, entitled Minimum Energy-Performance Standards (MEPS), were introduced as early as 1962 in Poland for a range of industrial appliances.

The French government set standards for refrigerators in 1966 and for freezers in 1978. Other European governments and Russia had also introduced legislation mandating efficiency information labels and performance standards during the 1960s and 1970s.

However, much of this early legislation was weak, poorly implemented, had little impact on appliance energy consumption and was repealed during the late 1970s and early 1980s, under pressure to harmonise European trading conditions (Waide et al. 1997).

Then, in 1976, came the US initiative on standards mandated by the state of California for energy efficiency. These standards

became effective in 1977 and were later followed by US national standards that became effective starting in 1988. These are believed to be the first energy efficiency standards that dramatically affected manufacturers.[7] They also achieved their objective of reducing the consumption of energy.

The concept of EE was for the first time mentioned in the documents of the "Environment for Europe" at the Aarhus Conference of Environment Ministers in June 1998.

The Declaration adopted at the conference stated "EE policy as one of the most significant steps towards the achievement of national and international goals in economy, environmental protection, sustainable energy supply and technologies that influence quality of life. EE improvements not only have the capacity to improve national economic efficiency and foreign trade but also have the capacity to enhance peoples' lives by lowering energy bills. This will in turn make energy services more affordable, thus enhancing labour markets and improving public and environmental health."[8]

Energy efficiency (EE) and sustainable economic growth have now become interrelated and interdependent processes. For various reasons, this has become a focus area for a large number of countries all over the world.

At the global level, governments are encouraged to regularly analyse and streamline their economic policies and practices with the concept of sustainable economic growth. Standards and labelling programme, which is one of the most important tools for energy efficiency, is getting deeply rooted.

In 2000 alone, around the world, 43 governments introduced the standards and labelling and the number has increased since then. It increased to 65 in the year 2007.

Importance of Energy Efficiency in the Emerging Global Scenario

Energy and Human Lives

Energy seems to have complete control of modern human lives, as the linkages between energy for economic growth and development have become more pronounced in the recent period. Energy has acquired both backward and forward linkages to human and non-human activities for development, or otherwise. It supports in production of goods and services, on the one hand, and facilitates usage of those producers by the end users, on the other. It has become an integral part in a way that modern society operates and people live.

For example, energy fuels businesses, helps run schools, hospitals and shops, supports human comfort, contributes to safety, facilitates education and enables people's movement. Energy is so embedded in human lives that decoupling energy from economic growth and human development appears to be an unviable option. In other words, it is indispensable for both economic growth and human development.

At the same time, the trend in traditional energy production and consumption does not appear to be sustainable in the longer run, as most of traditional energy sources are exhaustible in nature and also pose danger of increased CO_2 emission and climate change.

There are various risks associated with increasing and unsustainable use of energy. Most of the conventional energy sources are based on fossil fuels. Its unsustainable use can reduce the scope for future economic and human development. Increased CO_2 emissions and global warming resulting from increased usage of energy has now emerged as a serious concern.

Now, the focus of global community is not only on producing and using energy for economic growth and development but also ensuring production and use of energy on a sustainable basis.

Households, the users of electrical appliances, could make significant contribution in this aspect. Household and office electrical appliances represent the fastest-growing segments of the world's energy-consuming sectors, after transportation. Purchases of home electrical appliances – refrigerators, clothes washers, lighting products, ACs, computers and fax and photocopying machines – are increasing rapidly in line with improved living conditions and lifestyles of common people. This, in fact, is industrialising developing countries in a faster way. It is observed that the rate of growth in appliance ownership in developing countries is much higher than that in developed countries.

Need for Energy Efficiency in India

Demand for energy in India has increased significantly over the last two decades, especially after the introduction of the economic reforms programme in early 1990s. India's share in world energy hovers around four percent. With rising GDP and increasing per capita income of relatively affluent section of people, the demand for energy is expected to increase further in the coming periods. Studies show that India will account for the second-largest share, after China, in incremental energy demand in 2035. This makes it imperative for India to ensure its energy supply and to use available energy more efficiently.

Promoting energy efficiency could be one of the ways of ensuring energy supply in the longer periods. There are five specific reasons for which India needs to promote energy efficiency. These include: increasing energy requirement; increasing threat of climate change and other environmental considerations; energy security; lack of other supply options; and huge scope for energy efficiency measures.[9]

India also faces some additional problems like other developing countries in the energy sector. With increase in

Box 2.1: Per Unit Electricity Generation Cost by Sources in India

- Solar power: ranges from ₹12 to ₹14 per unit (there are also other estimates which put per unit cost in the range of ₹15 to ₹30)
- Conventional thermal energy: ranges from ₹2 to ₹6 per unit
- Hydro power: about ₹6 per unit
- Wind power: ranges from ₹2.75 to ₹3.50 per unit

the demand for conventional energy sources, leading to increase in their price over the last two decades, the cost of electricity generation is increasing. There are, of course, some new and renewable sources of energy (such as solar and wind) that have become prominent recently and have become the focus of world's attention.

However, these are at a very nascent stage and will take a long time to fully meet the growing energy demand. Moreover, in India and other developing countries, the per unit cost of electricity generation from such sources appears to be much higher than the conventional sources and also the required technology, at the moment, appears to be beyond the means of common consumers.

High cost of technology leads to higher per unit cost of electricity generation. Besides, this per unit cost varies from one source to another.

This makes achieving energy efficiency through power saving very important, as power is critical for ensuring growth and development of countries with a large number of people below the poverty line not only in India but across the world. It is often argued that one unit of power saved is more than one unit of power generated. Its importance grows further if one considers the life cycle of power generation and its adverse environmental impacts.

As reflected in the definition, EE is not an isolated term and is used in a context. In the present analysis, EE focuses on appliances – especially domestic – that run on electrical energy and which are at the core of this project. The present research report deals with and evolves around two main issues – *electrical energy and domestic electrical appliances* – and other directly and indirectly related issues to the EE.

It needs to be recognised that electricity – the source of energy to household electronic appliances – is a secondary source of energy and its generation and application is critically dependent on other energy sources – called primary energy – that are used to generate electrical energy.

Therefore, to understand the issue (EE) properly, it is pertinent to understand its origin, need, evolution, importance, adoption at country and international levels, potential beneficiaries and potentiality in ensuring economic growth and human development.

Current and Future Trend in the Demand for and Supply of Energy

Trend in Global Energy Consumption

Many of the developing economies, including India, are progressing at a rapid pace over the past two decades and so is the demand for and consumption of primary energy.[10] The sources of primary energy include coal, crude oil, sunlight, wind, running rivers, vegetation and uranium. These are used to produce secondary energy such as electrical energy. The generation of electrical energy, which is the focus of the present study, is thus linked to availability and accessibility of these primary energy sources.

The world's primary energy consumption shows an increasing trend for several decades now (even though it recorded a decline of 1.1 percent in 2009 over 2008). According to a report,[11] consumption of primary energy increased from

Table 2.1: Primary Energy Consumption in Million Tonnes of Oil Equivalent

Region	1990	2000	2009	Average Annual Increase (1990-2009)
North America	2316.0	2747.3	2664.4	18.3
South & Central America	321.2	456.9	562.9	12.7
Europe & Eurasia	3186.4	2797.2	2770.0	(-)21.9
Middle East	260.6	407.4	659.0	20.9
Africa	224.9	279.4	360.8	7.2
Asia Pacific	1787.4	2571.4	4147.2	124.2
World	***8096.5***	***9259.6***	***11164.3***	***161.4***

Source: Statistical Review of World Energy, 2011.

9259.6 million tonnes of oil equivalent (mtoe) in 2000 to 11168 mtoe in 2009, registering an increase of about 20 percent during the period (Table 2.1).

This gives an average annual growth of 2.3 percent for the nine-year period. This is significantly higher than the average annual growth rate of about 1.4 percent in 2000 over 1990 and slightly higher than the average growth rate of 2.2 percent in 1990 (8096.5 mtoe) over 1980 (6618.6 mtoe).

Region-wise, primary energy consumption data demonstrate a mixed trend from 2000 to 2009. The trend in primary energy consumption is not uniform across regions. While it increased in some regions, it declined in other regions. Regions that realised a decline in energy consumption include North America and Europe and Eurasia (consumption declined from 2747 and 2797 mtoe in 2000 to 2664 and 2770 mtoe in 2009, respectively).

On the other hand, two regions – Middle East and Asia Pacific – witnessed significant increase. Energy consumption of these two regions increased by over 61 percent over the nine-year period, realising an average annual increase of around seven percent. Africa and South and Central America

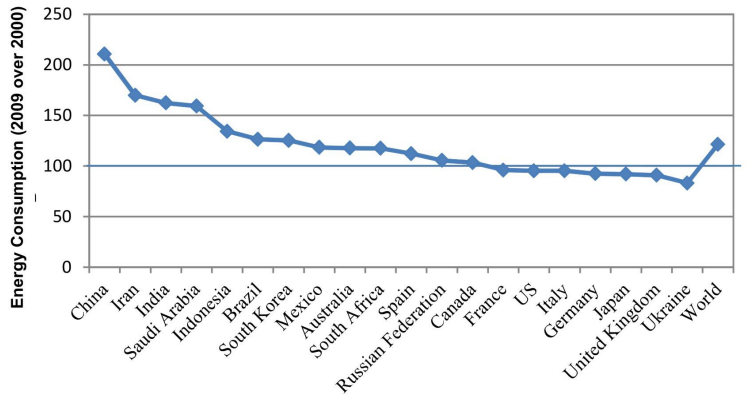
regions also realised growth, which was relatively higher than the global increase during the period.

Consumption of energy is linked to the development needs of the countries. And, this is the reason why it is observed that, while energy consumption in developed regions is declining, consumption in the emerging economies is increasing.

At the country level, data reveal that there are 19 countries whose primary energy consumption exceeded 100 mtoe in 2009. These 19 countries together constitute over 78 percent of the global consumption. Data analyses on these leading consumers reveal some interesting facts. It is observed that primary energy consumption levels in eight countries declined in 2009 and were below the 2000 level. These include France, US, Italy, Japan, UK, Germany, Ukraine, and Saudi Arabia (in that order). Consumption in other three countries (Canada, Spain and Russian Federation) is almost at the 2000-level.

However, it needs to be iterated that this decline or stagnancy could be due to various reasons, including financial

Figure 2.1: Energy Consumption (2009 over 2000)



Source: Statistical Review of World Energy, 2011.

crisis that started in 2007 and continued beyond 2009. Anecdotal evidence suggests that it has again started increasing in the recent period.

Compared to the above countries, emerging economies, namely, India, Indonesia, China, Brazil, Mexico, South Africa and others, have realised increase in primary energy consumption over the 2000-level.

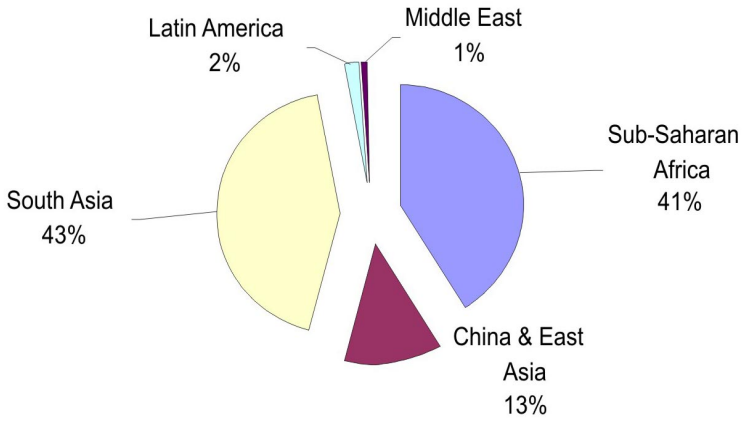
The trend is supported and reinforced by the recent development in the per capita power consumption. Data published by the World Bank[12] demonstrate that per capita power consumption, led by developing and emerging economies, is increasing for the last several years. The increase, however, is more in developing countries than in developed ones. The data reveal that there are 135 countries in 2009 whose per capita power consumption was more than 100 kg of oil equivalent.

Out of these, 81 realised increase in power consumption in 2009, compared to 2006. Most of these were developing countries. In contrast, 54 countries faced a decline in per capita power consumption during the period, with most of them being from the developed world.

However, it needs to be iterated that this decline for developed countries is on a higher base, as these countries consume multiples of power consumed by developing and least developed countries. Moreover, this decline is only a short-term phenomenon and is mainly due to adverse impacts of financial crisis.

In addition to the above delineation, there is also the other side of the story. Despite the continuous increase in energy consumption over several decades, there is still a large segment of the population, especially in the developing and least developed countries – 1.4 billion to be precise – who continue to be unaffected by the benefits of energy use. Lack of electrification is the main problem. Over 96 percent of these fall in Asia and Africa.

Figure 2.2: Distribution of Population without Access to Electricity



Source: Based on World Energy Outlook Database, accessed on April 27, 2011.
http://www.worldenergyoutlook.org/database_electricity/electricity_access_database.htm

In case of India, as per data 2009, 90,000 villages constituting about 15 percent of the total are yet to be electrified. Similar situations exist in other countries also, but more in Asia and Africa. Governments in most of the countries are, however, taking initiatives to improve the situation.

Future Projection in Energy Consumption

The increasing trend in primary energy consumption is expected to continue in the coming decades with every increase in gross domestic product (GDP), as it has positive linkage with GDP growth. Besides, taking into account the development needs across the regions, it is beyond any doubt that the demand for and consumption of energy in the coming periods will increase further.

This is reflected by studies, as indicated above, showing that energy requirement, especially by the developing world,

will see significant increase in the coming decades. High GDP elasticity of energy consumption further reinforces the agreement. According to one estimate, the GDP elasticity of energy consumption is 0.7 from 1980 to 2007 period and 0.5 for the period 2007 to 2035.[13]

The magnitude of this increase will be determined by the push for growth in GDP of different economies, especially the emerging ones. It will also be influenced by development strategies of developing and LDCs.

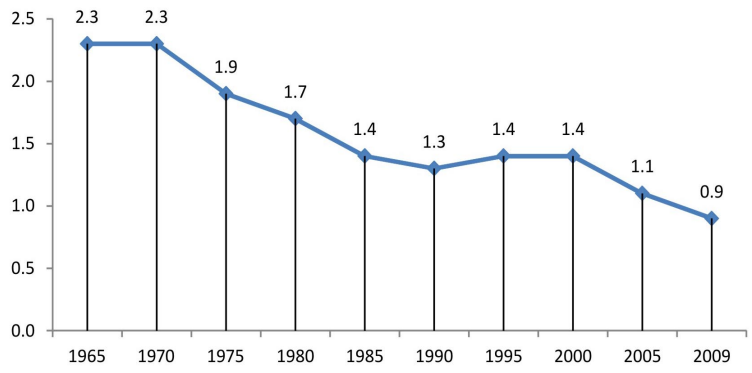
According to one report, the world primary energy demand is anticipated to increase at an average annual growth rate of 1.5 percent under annual GDP growth of 2.8 percent.[14] This will lead to increase in demand for primary energy to 16.9 billion tonnes of oil equivalent (btoe) in 2035, a 1.5-fold increase from the current level of 11.1 btoe.

Another report, consistent with the preceding one, published by the National Petroleum Council (NPC), US, predicts a 50-60 percent growth in total global demand for energy by 2030.[15] Most of the growth occurs in emerging economies outside the Organisation for Economic Cooperation and Development (OECD), especially in non-OECD Asia.

Total non-OECD energy use increases by 84 percent in the reference case compared with a 14-percent increase in the developed OECD nations.[16]

The above statement is reinforced by declining ratios of the OECD to non-OECD countries in total energy consumption. The decline started in the seventies and is continuing till 2000. Even in the later period, evidence suggests that the trend is continuing as shown in Figure 2.3. Emergence of other countries – such as BRICS – as major consumers of energy is said to be the primary reason for this. However, a proportion of this decline might be from energy efficiency measures taken by the OECD countries over the last several years.[17]

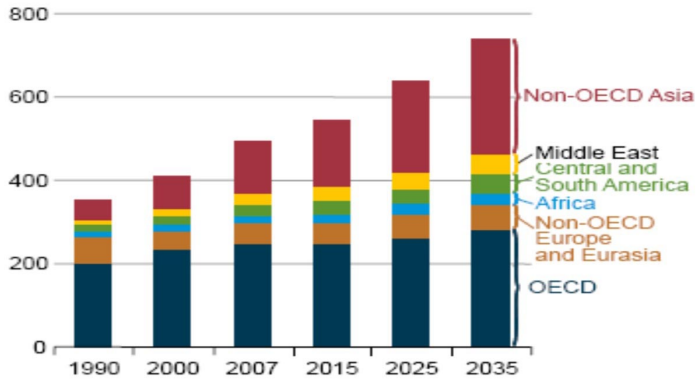
Figure 2.3: Ratio of OECD Energy Consumption to Non-OECD countries



Source: Statistical Review of World Energy, 2011.

The report gives a clear indication that energy use in non-OECD Asia is projected to increase by 118 percent over the period. Strong growth is also projected for much of the rest of the non-OECD regions. Consumption in the Middle East will

Figure 2.4: World Energy Consumption by Region, 1990-2035
(Quadrillion Btu)



Source: Adapted from Annual Energy Outlook 2011 with Projections to 2035, accessed on June 4, 2011.

grow by 82 percent, in Africa and Central and South America by 63 percent. Compared to this, consumption in other non-OECD countries in Europe and Eurasia will also make substantial gains through energy efficiency.

A large number of countries in Asia will achieve significant growth in energy consumption. Some of these include China, India, Vietnam, Thailand, Malaysia, Indonesia and other ASEAN countries. According to another report,[18] primary energy consumption in China is projected to increase at an average annual rate of 2.4 percent and would amount to 3.5 btoe by 2035, almost twice as much as 1.8 btoe in 2007. Compared to China, primary energy demand in India will increase sharply at 3.7 percent per annum and would reach 1.2 btoe, around 2.8 times more than the 2007 figure of 0.4 btoe.

The report further shows, while China will account for 29 percent of the incremental increase in the world primary energy demand of 2035, India will account for 13 percent. The combined share of China and India in total world energy consumption is forecast to increase from 20 percent in 2007 to 28 percent in 2035.

The report forecasts that per capita energy consumption in China and India in 2035 will remain below the level of developed countries. Therefore, both China and India will continue to have large potentiality of expanding their energy demand even beyond 2035.

Potential Constraints to Increasing Energy Supply in the 21st Century

More energy production on a sustained basis will be required to meet the projected energy consumption. The task will be challenging considering the fact that most of the energy sources are finite and, more importantly, it requires significant technological advancement, capital investment and manpower.

Even if one considers that during the medium term (covering the projection period) there will be plenty of hydrocarbons available to meet the demand, significant other constraints will be encountered to produce sufficient energy to meet the increasing global demand.

Some of the most important constraints will be CO_2 emission standards, limitations on research and development expenditure, increasing capital requirements, manpower limitations, among others.

Environmental Constraints

Energy production and consumption, a critical input for growth and development, has direct adverse impacts on the environment through CO_2 emissions and waste generation. This has now become a global issue. In the emerging scenario of increasing need for energy, countries need to balance their development strategies with strategies that limit environmental deterioration. Thus, to continue using hydrocarbon fuels for development and other purposes and, at the same time, address environmental issues, the world needs to develop appropriate technology, as well as the legal and regulatory framework to enable carbon capture and sequestration.

The development of clean-burning coal technology to address CO_2 emissions will be very important in allowing the continued use of coal for the generation of electricity. In addition, the industry needs to resolve issues involving land use, waste disposal, habitat, and sound.

It will pose serious challenges, especially to developing world, which is way behind as far as developing appropriate technology is concerned. Unavailability and inaccessibility of such technologies could make the task of achieving the dual purpose of protection of environment and promoting development a very difficult task for the developing countries. Lack of financial support from the developed countries could further complicate the matter.

Technology Constraints

Developing and using better technology will be the key to optimising the production of primary sources of energy such as oil and gas. Studies suggest that the industry and governments should be putting more money for developing appropriate technology, through research, to facilitate increased energy production, which, in turn, could help development. In the absence of suitable technology, meeting future energy demand will be a challenging task and could be a big drag for developing countries in meeting their future energy requirements.

Capital and Manpower Constraints

According to the NPC estimate, the worldwide investment in energy will be US$20tn during the next 25 years. Higher investment in real terms will be needed to grow production capacity, as future projects are likely to be more complex and remote, resulting in higher costs of energy produced. It will have its impact on developing nations. Even though the share of developing nations will be quite low in the total investment, but it might not be an easy task for them.

Another big constraint in meeting the growing energy demand of developing countries in the coming years could be the unavailability of technical manpower.

Constraints and their Potential Impact on Electricity Generation

Electricity is a secondary energy and is generated through the use of different sources of energy, as discussed above. Therefore, constraints which could hamper production of energy would also adversely impact electricity generation, since electricity generation is directly dependent on primary sources of energy.

Data available indicate that there is no given pattern for use of these energy sources in electricity generation. Most of

the countries use a mix of energy sources and are not critically dependent on one source. It is observed that the energy-mix varies from one region to another and also from one country to another within the same region, depending on the availability and easy accessibility of different types of energy sources.

While some countries (US) use more nuclear energy, others (like India) use coal or other sources as primary energy for electricity generation. This has the potential to create space for shifting from one type of energy to another or a mix of different energy sources, especially renewable energy sources.

The task, however, might be challenging for developing countries and LDCs because of their lack of exposure to appropriate technology and capital requirement.

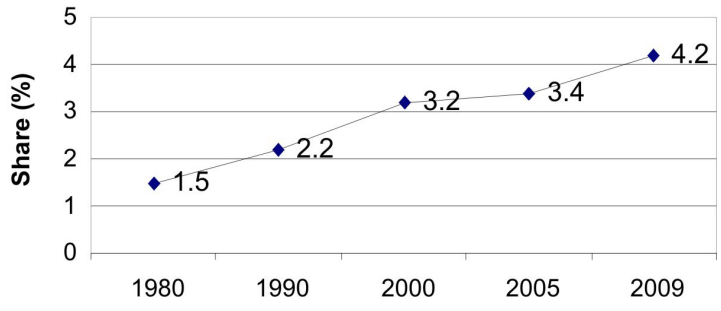
India on World Energy Map

India is one of the fastest growing economies of the world and so is its energy consumption. Energy consumption in India has consistently been increasing since 1980. It increased from 102.5 mtoe in 1980 to 180.7 mtoe in 1990, an increase of over 78 mtoe over the ten-year period. The increase was even more impressive during the post-reform period, as consumption increased by about 115 mtoe in the decade ending 2000.

The trend continued even in the later years. In the nine-year period till 2009, consumption increased by over 106 mtoe. The consumption in quantitative terms is placed at 469 mtoe in 2009. India's decadal increment in 2009 (106 mtoe) was more than the individual energy consumption of about 50 countries, including Taiwan (105 mtoe), Thailand (95 mtoe), Netherlands (93 mtoe) and many others.

This impressive increase in energy consumption is because of improved and sustained economic growth over the last two decades.

Figure 2.5: India's Share in World Energy Consumption (%)



Source: Statistical Review of World Energy, 2011.

The changing pattern in energy consumption is duly reflected in India's increasing share of the world consumption of energy. India's share has increased by almost three times from 1.5 percent in 1980 to 4.2 percent over the last three decades (Figure 2.5). The increase was more impressive in the post-reform period with Indian economy gaining a higher growth trajectory. India now occupies the fourth position in the overall consumption of energy, after the US, and China occupying the first position (19.5 percent share each) and the Russian Federation occupying (5.7 percent) the third position.

Data show that energy consumption is unevenly distributed throughout the world. Interestingly, the first two countries account for nearly two-fifth (39 percent) of the total energy consumption and the first ten countries have a consolidated share of 65 percent. As for India, its consumption is higher than many of the developed countries, including Japan, Canada, Germany, France and others. A comparative map of countries in terms of their share in global energy consumption is given in Annexure 2.1.

India, like many other countries, uses a mix of sources – oil, natural gas, coal, nuclear, hydro – to meet its energy requirements. Recently, renewable energy is also emerging as

Table 2.2: India's Consumption of Primary Energy by Source

Source	*1980*	*1990*	*2000*	*2009*	*India's Share in the World (2009)*
Oil Consumption (mt)	31.6	57.9	106.1	148.5	3.8%
Natural Gas Consumption (mtoe)	1.1	10.8	23.7	46.7	1.8%
Coal Consumption (mtoe)	56.7	95.5	144.2	245.8	7.5%
Nuclear Consumption (mtoe)	0.6	1.4	3.6	3.8	0.6%
Hydrocarbon Consumption (mtoe)	12.5	15.0	17.4	24.0	3.2%
Primary Energy Consumption (mtoe)	102.5	180.7	295.1	468.9	4.2%

Source: Statistical Review of World Energy, 2011.

an important source, but it still has a long way to go to make a significant contribution.

Data on energy-mix show that, while natural gas consumption has increased by over four times, oil, nuclear and coal consumption increased by over 2.5 times during the 1990-2009 period. Consumption of hydro energy has also increased. Overall, the consumption of primary energy has increased by more than 2.6 times over the past two decades.

In comparison to the consumption trend, production has a mixed trend during 1990 to 2009. While oil production has remained almost constant, production of natural gas has

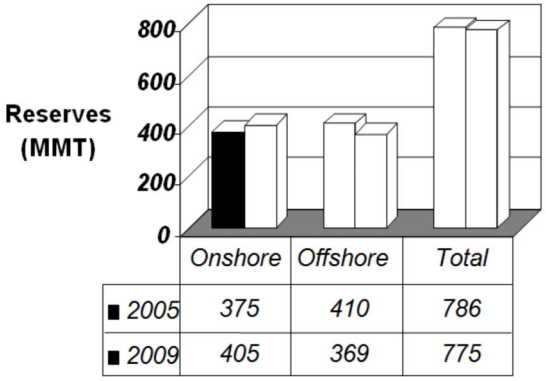
Table 2.3: Production of Primary Energy by Source

Source	*1980*	*1990*	*2000*	*2009*	*India's Share in the World (2009)*
Oil production (mt)	9.4	34.2	34.2	35.4	0.9%
Natural Gas Production (mtoe)	1.1	10.8	23.7	35.3	1.3%
Coal Production (mtoe)		91.9	132.2	211.5	6.2%

Source: Statistical Review of World Energy, 2011.

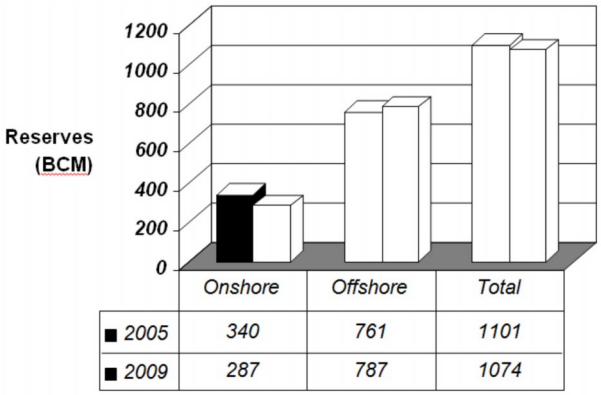
increased by over three times and coal by over two times. This alone, however, is not sufficient to effectively meet the growing energy demand and it is not unlikely that it could pose serious challenge in sustaining India's economic growth in future.

Figure 2.6: Oil Reserves in India



	Onshore	Offshore	Total
2005	375	410	786
2009	405	369	775

Figure 2.7: Natural Gas Reserves in India



	Onshore	Offshore	Total
2005	340	761	1101
2009	287	787	1074

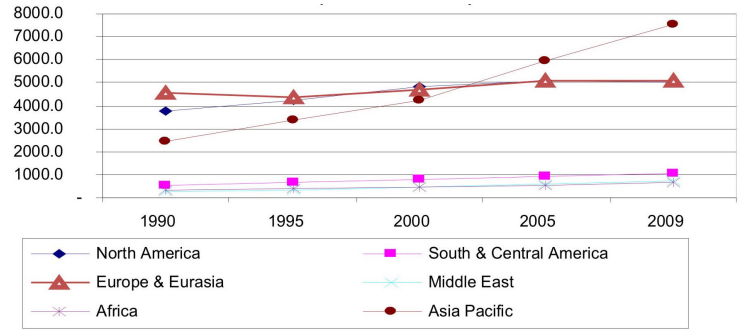
Source: Statistical Review of World Energy, 2011

Juxtaposing consumption with production shows that the gap between the two – production and consumption – is increasing in favour of the former over the last few years. There is, in fact, no significant development as far as meeting domestic demand through domestic production is concerned. Data on two important energy – oil and natural gas – sources indicates that proven reserves have, in fact, gone down in 2009, as compared to 2005. This could further widen the demand-supply gap and adversely impact India's prospects for successfully meeting its energy requirements in future.

Electricity Generation Trend in India and the World

Electricity generation is a function of availability of primary sources of energy, other things remaining constant. The world, as a whole, generated about 20,090 terawatt-hours (tw-h) of electricity in 2009, as compared to 15,300 tw-h in the year 2000 and 11,850 tw-h in 1990. It translates into an average annual increment of 433 tw-h in the mentioned period. Wide variations are recorded at the regional and national levels. The percentage increase in global generation in about two-decade period was lower than that of many countries at the national level.

Figure 2.8: Electricity Generation by Region
(Terrawatt-hours)



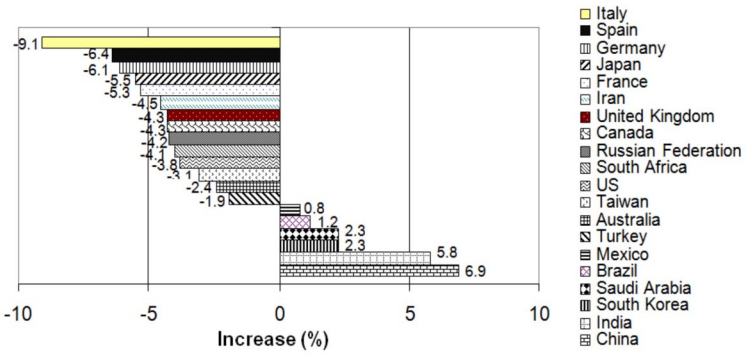
Source: Statistical Review of World Energy, 2011.

During the same period (from 1990 to 2009), electricity generation in India has increased by three times from 284 tw-h in 1990 to 870 tw-h in 2009. India added 586 tw-h, which is about seven percent of the total global increment. This works out to an average annual addition of 30 tw-h, or about seven percent of global annual addition in the mentioned period.

At the country level, recent data indicate that different countries have performed differently in generation of electricity. While some of the major producers have witnessed decline in electricity generation, others, especially in developing world, have performed impressively. The decline in major countries may be due to various reasons, including, but not limited to, financial crisis. Figure 2.9 gives a clear picture of how major consumers of electricity have performed in recent years. Out of 20 countries, which are major producers of electricity and account for over 80 percent of electricity generation, 14 countries realised a decline in electricity generation.

In comparison, six counties, mainly emerging and developing ones, recorded significant increases. Since most of the latter group of countries is in development phase, it is expected that

Figure 2.9: Increase in Electricity Consumption (2009 over 2008)



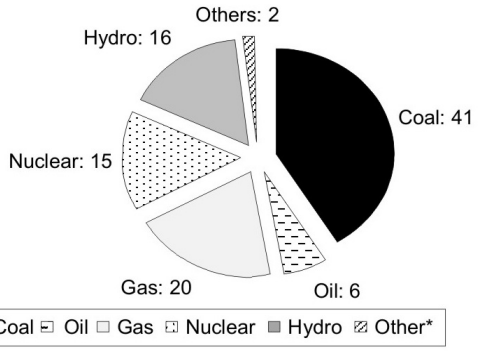
Source: Statistical Review of World Energy, 2011.

their electricity requirements will keep on increasing in the coming years and so their need for electricity generation.

Fuels as Source of Electricity Generation

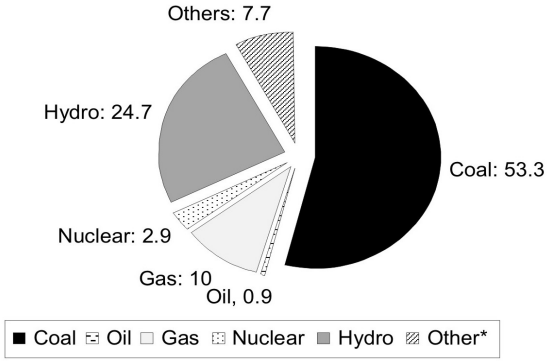
As in other countries, India uses a mix of energy sources for electricity generation. However, it is predominantly coal-based, as it contributes to more than 50 percent of electricity generation in India. A comparative picture of global and India's

Figure 2.10: World Electricity Generation by Source (%)



Source: World Coal Association, http://www.worldcoal.org/coal/uses-of-coal/coal-electricity/

Figure 2.11: India's Electricity Generation by Source (%)



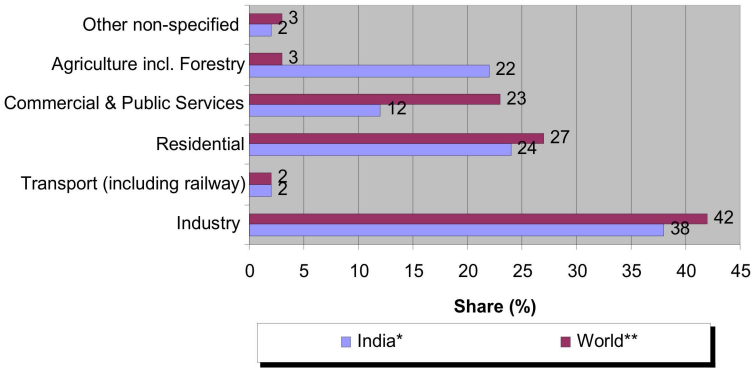
Source: CEA 2009.

energy-mix is presented in the following pie-chart (Figures 2.10 and 2.11).

Electricity Consumption by Sector

Industry is the largest consumer of electricity in India. Industry accounts for about 38 percent of the total electricity consumed in India. Residential and agricultural sectors are the other major consumers, with shares of 24 percent and 22 percent, respectively, in total electricity consumption. This is in sharp contrast to the global consumption pattern of electricity, as indicated in Figure 2.12.

Figure 2.12: Electricity Consumption by Sector: India and the World



Need for Integrating Energy Efficiency with India's Economic Growth Strategy

The link between energy efficiency and energy saving (and thus sustainable economic growth) is now clearly established. A higher level of efficiency leads to a higher level of energy saving and also to higher sustainable growth. At the same time, it also helps in reducing electricity bills to the consumers.

A report by the United Nations indicates that, in the US, every US$1 of taxpayer's money spent by the government on existing efficiency standards will result in US$350 to US$440

investment by consumers on energy efficiency and US$610 to US$760 net savings from fuel reductions over the life of those standards.[19] This can also happen in other countries, including India, which are opting for energy efficiency.

The situation in India is slightly different, as a significant number of people estimated over 400 million, have no access to electricity and limited access to other clean, modern fuels such as LPG and kerosene. This is despite the fact that India produces over 660 billion KWh of electricity.

Limited energy access is reflected in the relatively low Human Development Index of India. This requires sustained increase in energy supply over a longer period and calls for an inclusive approach to simultaneously addressing the twin issues of development and energy efficiency. Integrating energy efficiency with growth might lead to significant improvement in the energy scenario.

Integrating energy efficiency with growth strategy can specifically lead to three specific benefits for the nation and its people:

- Reduction of capital investment in energy supply infrastructure: EE improvement reduces future investments in costly power plant construction. This frees capital for more economically advantageous investments.
- Enhancement of economic efficiency by reducing energy bills: The reduced future investments apply equally to energy spending. EE reduces future investments in energy acquisition, delivery and use. This means a more efficient energy sector that will result in a more efficient economy.
- Meeting climate change mitigation goals and reducing pollution: Reducing energy consumption and improving EE decreases carbon emissions from fossil-fuel power plants and end-use energy products and equipment.

Meanwhile, reducing energy consumption also decreases emissions of sulphur dioxide, nitrogen oxides, particulate matter and other toxic gases and aerosols.

Promoting EE also leads to some other benefits. These include:

- Enhancing consumer welfare;
- Strengthening competitive markets; and
- Averting urban/regional pollution.

The initiatives taken have already started bearing fruits for the economy. Over the past decade, especially since 2004, it is observed that energy intensity of GDP has declined. This is despite the fact that gains in both poverty reduction and economic growth have been significant. The reduced energy intensity has been marked by an economic growth rate of over eight percent per annum and, more importantly, this has been achieved with an energy growth of less than four percent per annum.

These policies have been driven by the imperatives of sustainable development and have also led to a decline in the intensity of energy use and carbon dioxide emissions, as a co-benefit. India's energy intensity is much lower than that of developed countries and a large number of developing countries. Lower energy intensity has helped India achieve lower per capita energy consumption (which is less than 500 kgoe, compared to the global average of nearly 1,800 kgoe), creating huge scope for decision makers to decide India's future course of action suitable to its development requirements.

Bringing in an era of energy efficiency through use of energy efficient products and technology could lead to many positive developments. Estimates show that such transformation[20] could lead to the following:

- Eliminate India's energy deficit by 2014;
- Add approximately US$500bn to its GDP between 2009 and 2017;

- Reduce local air pollution, including emissions of sulphur dioxide and nitrogen oxides; and
- Prevent 65 million tonnes of carbon dioxide emissions by 2017.

If achieved, this would undoubtedly be a great achievement. However, people could always doubt whether India would be able to bridge its energy deficit by 2014, especially considering the fact that a significant segment of the population is unaware of the benefits of energy use, more specifically use of electrical energy.

As stated earlier, India is now the fourth-largest consumer of energy in the world. With the potential for impressive economic growth in the coming decades, the energy consumption is further expected to increase – by 2030 India is expected to become the third-largest, overtaking Russia. This jump will be premised on energy uses. India's commercial energy consumption during the period is expected to more than double to 812 mtoe (Tanvi Madan, 2006). The quantum increase in energy consumption will involve use of all available energy sources such as coal, oil, gas and electricity generated from nuclear, hydroelectric and renewable sources. But, what is important here is that all of these sources will be over-exploited due to the world's increasing need for energy during the period.

In addition, the demand-supply gap between energy required and energy available is quite significant in India, as in many other countries. All of the regions are passing through a deficit phase in energy requirement and energy availability, on the one hand, and peak demand and peak met, on the other hand.

To bridge this deficit, India needs to generate about 20 percent more energy. Now, this energy can either come through generation or conservation. But, the important thing is by the time India increases its energy generation by 20

percent, its energy demand will have increased by about two times.

Promoting energy efficiency is, therefore, critical for sustaining economic growth and lifting people who are below the poverty line. In short, it can facilitate achievement of sustained and inclusive growth. India's initiative on energy efficiency over the last few years has resulted in energy saving, as reflected by the decline in energy intensity of GDP. This needs to be further strengthened in the coming years.

Annexure 2.1: Primary Energy Consumption

Rank	Country	Share in 2009 (%)	Rank	Country	Share in 2009 (%)	Rank	Country	Share in 2009 (%)
1	US	19.5%	11	Iran	1.8%	21	Taiwan	0.9%
2	**China**	19.5%	12	UK	1.8%	22	Thailand	0.9%
3	Russian Federation	5.7%	13	Saudi Arabia	1.7%	23	Netherlands	0.8%
4	India	4.2%	14	Italy	1.5%	24	Turkey	0.8%
5	Japan	4.2%	15	Mexico	1.5%	25	Poland	0.8%
6	Canada	2.9%	16	Spain	1.2%	26	Egypt	0.7%
7	Germany	2.6%	17	Indonesia	1.1%	27	United Arab Emirates	0.7%
8	France	2.2%	18	South Africa	1.1%	28	Venezuela	0.7%
9	South Korea	2.1%	19	Australia	1.1%	29	Argentina	0.7%
10	**Brazil**	**2.0%**	20	Ukraine	1.0%	30	Belgium & Luxembourg	0.6%
	Total	**64.9%**		**Total**	**13.8%**		**Total**	**7.6%**
31	Pakistan	0.6%	41	Greece	0.3%	51	China Hong Kong SAR	0.2%
32	Kazakhstan	0.6%	42	Austria	0.3%	52	Turkmenistan	0.2%
33	Singapore	0.5%	43	Kuwait	0.3%	53	Bangladesh	0.2%
34	Malaysia	0.5%	44	Switzerland	0.3%	54	Hungary	0.2%
35	Uzbekistan	0.5%	45	Colombia	0.3%	55	Portugal	0.2%
36	Sweden	0.4%	46	Chile	0.3%	56	New Zealand	0.2%
37	Norway	0.4%	47	Qatar	0.2%	57	Bulgaria	0.2%
38	Algeria	0.4%	48	Finland	0.2%	58	Slovakia	0.2%
39	Czech Rep.	0.4%	49	Philippines	0.2%	59	Peru	0.1%
40	Romania	0.3%	50	Belarus	0.2%	60	Denmark	0.1%
	Total	**4.5%**		**Total**	**2.5%**		**Total**	**1.8%**

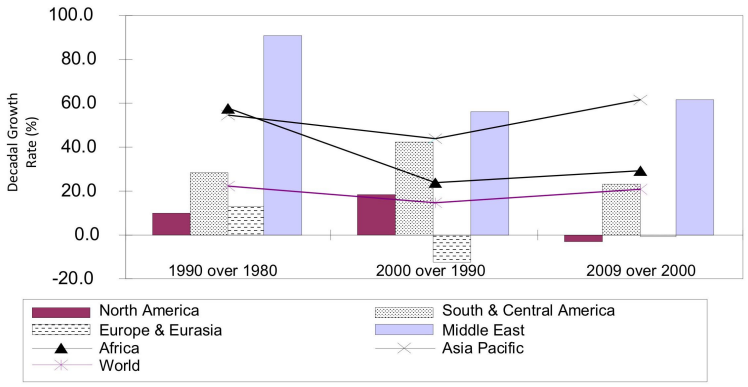
Source: Statistical Review of World Energy 2010.

Annexure 2.2: Decadal Nominal Increase in Primary Energy Consumption (%)

Region	1990 (over 1980)	2000 (over 1990)	2009 (over 2000)
North America	9.8	18.6	-3.2
South & Central America	28.8	42.3	23.2
Europe & Eurasia	12.8	-12.2	-0.9
Middle East	91.1	56.3	61.8
Africa	57.8	24.2	29.1
Asia Pacific	54.4	43.9	61.3
World	***22.3***	***14.4***	***20.6***

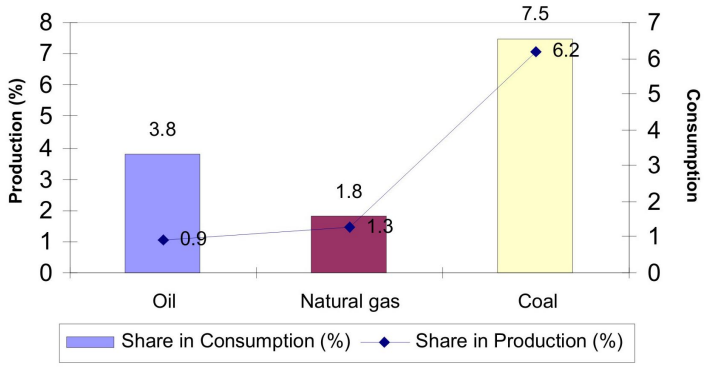
Source: Computed from Statistical Review of World Energy, 2011.

Annexure 2.3: Trend in Decadal Nominal Growth in Energy

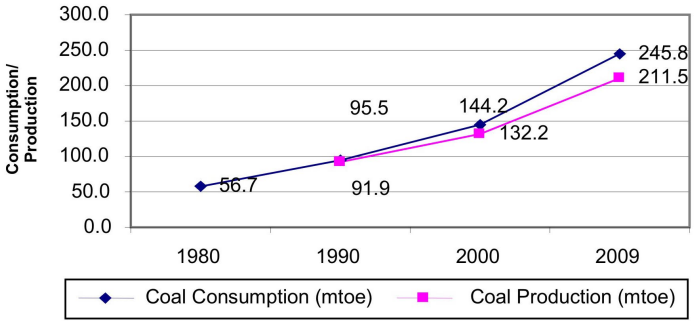


Annexure 2.3: Trend in Decadal Nominal Growth in Energy

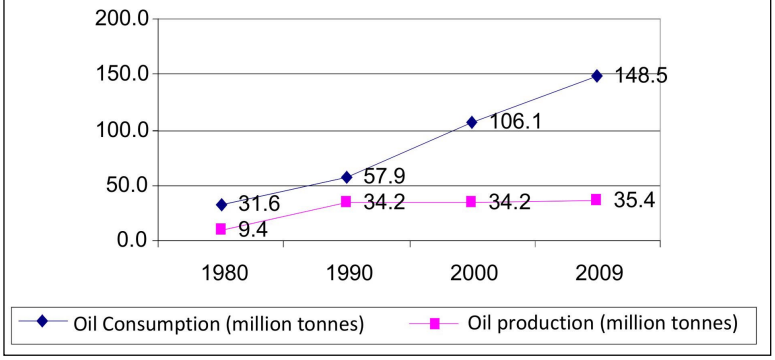
Annexure 2.4: India's Share in Global Energy Consumption and Production



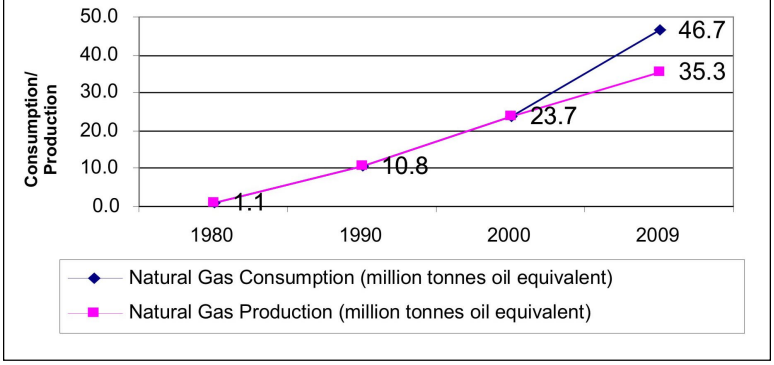
Annexure 2.5: Consumption of Coal Increasing at a Faster Pace than Production (mtoe)



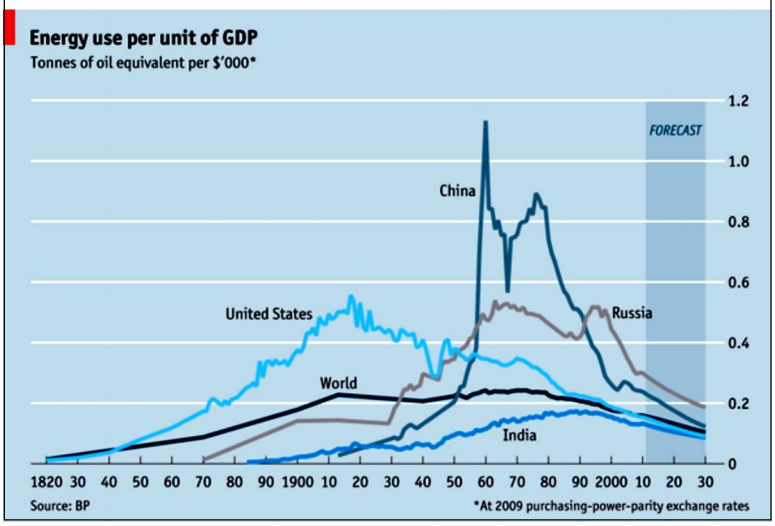
Annexure 2.6: Widening Gap in Consumption and Production of Oil



Annexure 2.7: Consumption of Natural Gas Increasing at a Faster Pace than Production



Annexure 2.8: Energy Intensity: Past and Future



Adapted from The Economist, http://www.economist.com/blogs/dailychart/2011/01/energy_use accessed on June 24, 2011.

Chapter 3

A Review of Progress Made in the Promotion of Energy Efficient Products in India

Current Energy Scenario in India

India's increasing energy consumption over the last two decades has made significant contribution in the growth achieved in the fields of industry, agriculture, communication, transport and other sectors. Its primary commercial energy consumption was recorded at 468.9 mtoe in 2009, with the main sources of energy being coal, oil, gas and electricity generated from nuclear, hydroelectric and renewable sources. This growth needs to be sustained in the coming periods and it is very likely.

Sustaining this growth, coupled with the need to promote development, necessitates mounting consumption of energy for developmental and economic activities. India is already projected to overtake Japan and Russia in energy consumption by 2030.

India will face challenges to meet its energy requirements as present power system in India is inadequate to meet the

Table 3.1: Region-wise Power Shortage Situation in India in 2007-08

Region	Energy Requirement (MU)	Energy Availability (MU)	Deficit (%)	Peak Demand (MW)	Peak Met (MW)	Deficit (%)
Northern	219,797	196,147	10.8	32,462	29,495	9.1
Western	247,173	208,223	15.8	38,277	29,385	23.2
Southern	187,743	181,820	3.2	26,777	24,368	9.0
Eastern	75,833	72,099	4.9	12,031	10,699	11.1
North Eastern	8,799	7,713	12.3	1,742	1,347	22.7
All India	739,345	666,007	9.9	108,866	90,793	16.6

Source: http://infrastructure.gov.in/pdf/FinalReport_of_Task.pdf

existing demand and there are both peak demand and electricity shortages. This is reflected in Table 3.1. This shortage is making policy makers, businessmen, media persons and civil society organisations realise that the country is in an increasingly difficult position to sustain its economic growth by using non-renewable sources of energy at the prevailing levels of energy efficiency. And, therefore, energy efficiency needs to be promoted across sectors and people.

Stocktaking of Standards and Labelling Programmes in India

With the widening demand-supply gap, increasing energy costs and unsustainable energy consumption and furthermore considering that India's energy demand will expectedly more than double by 2030, there is a pressing need to develop innovative ways to conserve energy. To meet the needs of the future, investments are necessary in the present. One of the key ways of managing current shortage and, at the same time, addressing future need of power is through efficiency enhancement and conservation of energy resources.

The Government of India has put in place an overarching legal, regulatory and policy framework to promote market-

based energy efficiency in Indian economy. These include enactment of enabling legislation (Energy Conservation Act, 2001), institutional arrangements at the Central and State levels for regulatory oversight (Bureau of Energy Efficiency and State-Designated Agencies), Action Plan for promoting energy efficiency (2007-2012) and the National Mission for Enhanced Energy Efficiency.

Promoting and facilitating the use and popularisation of the energy-efficient (EE) products through standardisation and labelling process is at the core of various initiatives. EE standards, as a concept, are procedures and regulations that prescribe the energy performance of end use appliances. The standards target a particular appliance (or equipment) by means of well-defined protocols where sufficiently accurate estimate of energy performance can be obtained in the ways it is typically used, or at least a relative ranking of its energy performance compared to other models.

India's energy strategy, therefore, focuses on two goals, i.e. increasing reliance on renewable energy and enhancing energy efficiency at various levels. Since infrastructure for producing renewable energy is at a nascent stage and it will take years for India to fully or even largely meet its increasing energy needs through renewable resources, promoting energy efficiency across sectors is perhaps the best viable strategy for avoiding energy scarcity. This, in turn, can aid sustained economic growth and also protection of the environment.

For enhancing energy efficiency of the country as a whole, there has to be a simultaneous increase in the production and consumption of energy efficient products. Importantly, it needs to be ensured that the consumers are aware of the benefits of purchasing energy-efficient products, both from an economic and environmental point of view, as well as from the national perspective of conservation of scarce and possibly exhaustible sources of energy. Such awareness and concomitant consumer

behaviour is a crucial determinant of use of energy-efficient products. According to a speech delivered by the Union Minister of Power during the seminar on National Campaign for Energy Efficiency & Conservation, the Ministry of Power and the Bureau of Energy Efficiency has undertaken many awareness programmes to educate the masses about the efficient use of energy and its conservation. A postage stamp on energy conservation was released by the Hon'ble Prime Minister as a part of the national campaign to help create a movement for energy conservation in the country.

However, he underlined the fact that there is need for more vigorous and focused National Awareness Campaign to focus on the creation of public awareness, understanding the significance of the energy conservation and promotion of energy conservation through voluntary action.

The campaign should target the domestic, commercial, agricultural, industrial and educational sectors. According to the Minister, the focus of the national campaign should include:

- Spreading information about energy situations, simple energy saving methods that can be applied in everyday life. This is intended to serve as a foundation for the subsequent campaigns in the following years;
- In terms of the communication strategy, mass media and campaign events are planned to be used to create energy conservation awareness effectively and rapidly among audiences nationwide at the initial stage;
- Present a wider variety of energy conservation methods to improve energy consumption behaviour, including prevention of energy waste and leakage; and
- Information about power and oil situation and their rising prices and effectively meeting this challenge through energy saving and substitution.

Energy Efficiency: Need for Awareness Generation

Consumer awareness is imperative for successful implementation of energy efficiency and conservation measures. However, such degree of awareness among the mass varies from country to country. If people are uninformed, the substantial potential of behavioural interventions to reduce energy consumption may go unrealised.

A 2009 press release by Gartner states that their survey in United Kingdom and United States of America found that consumers are generally interested and willing to participate in energy efficiency programmes, but are not fully aware of the programmes offered by their providers.[21]

Gartner surveyed more than 4,000 households between December 2008 and January 2009 to look into particularly the consumer's willingness and enthusiasm to participate in energy efficiency programs offered by utilities. Also, the survey found that there are remarkable regional disparities between the two countries when it comes to consumer awareness of energy efficiency programs. The survey found that consumers in UK are less aware of energy efficiency programmes than consumers in the US (68 percent vs 55 percent).

Gartner attributes such regional differences to two key factors. The first is the variation on emphasis toward energy efficiency as an integral part of the national energy policy between the UK and the US. Despite the UK white paper on energy conservation and a number of European Community (EC) initiatives, the English legislation is by no means as evolutionary as American energy policy.

Secondly, the unbundled nature of the competitive energy retail market in the United Kingdom makes it harder to tag an entity (for example, a network company or competitive supplier) responsible for market energy efficiency programmes. This is because utility benefits are fragmented and retail entities that own consumer relationships are not interested in potential utility-asset-related benefits.

A report of the international workshop on cleaner production and energy conservation held at Kochi in 2008 states that energy conservation facilitates the replacement of non-renewable resources with renewable energy. It is often the most economical solution to energy shortages and is a more environmentally benign alternative to increasing energy production.

It represents a cost-effective approach to raising profitability, enhancing competitiveness and improving environmental performance, thereby ensuring sustainable development.

Energy efficiency may not only bring reductions in carbon dioxide emission but also lead to savings in the expenditure on energy (Yukata Mizuta, 2003). It should, therefore, be one of the first topics to receive the attention of the government. Besides saving money, energy-saving effort can also improve the quality of the environment and extend the life span of non-renewable energy resources.

Energy Efficiency and National Standards and Labelling Programme (S&L) Scheme

Energy labelling is one of the most cost-effective policy tools for improving energy efficiency and lowering energy cost for the consumers. The Energy Efficiency S&L Programme is a key area for energy efficiency and has been successfully implemented in many countries. The programme has brought significant impacts in terms of availability of higher quality energy-efficient products in the market places, resulting in energy as well as money savings for consumers on use of energy labelled products, a healthy competition in the markets through market transformation and lesser pressure on generation of additional power.

These measures tend to encourage the manufacturers to produce energy-efficient products and also help consumers to

make an informed choice before buying these appliances. Energy efficiency labels and standards for appliances and equipment offer a huge opportunity of improving energy efficiency (Annual Report 2006-07, Ministry of Power).

The experience of other countries shows that standards and labelling programmes are helping countries to reduce energy saving in a significant way. For example, the implementation of S&L Programme in the US alone has displaced over fifty thousand MW of electricity. In addition to energy savings, to some extent, it is helping in addressing the issue of climate change through reduction of greenhouse gases (GHG), including carbon dioxide.

In India, the responsibility of bringing in an era of energy conservation and energy efficiency lies with the Bureau of

Box 3.1: Broad Objectives of BEE

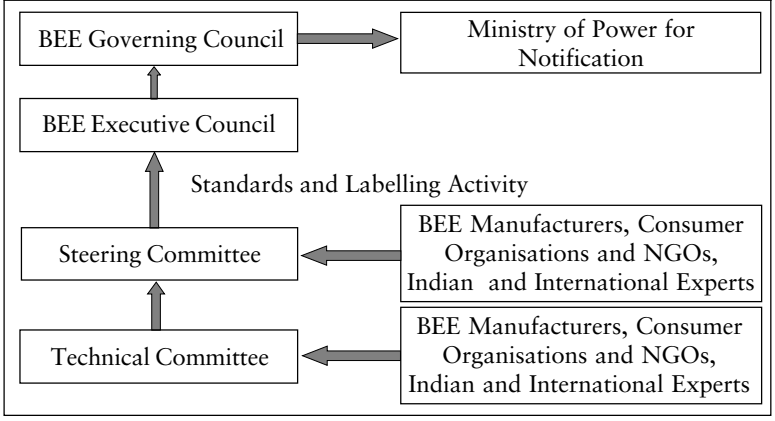
- To provide policy recommendation and direction to national energy conservation and efficiency efforts and programmes;
- To coordinate energy efficiency and conservation policies and programmes and take them to the stakeholders;
- To establish systems and procedures to measure, monitor and verify energy efficiency results in individual sectors as well as at a macro-level;
- To leverage multi-lateral and bi-lateral and private sector support in implementation of Energy Conservation Act and efficient use of energy and its conservation programs;
- To demonstrate delivery of energy efficiency services as mandated in the EC bill through private-public partnerships;
- To interpret, plan and manage energy conservation programmes;
- Coordinate policies and programmes on efficient use of energy with shareholders.

Energy Efficiency (BEE). The BEE was created in 2002 as a government agency under the provisions of the 2001 Energy Conservation Act. The Agency is a statutory body under the Ministry of Power. The agency's function is to develop programmes which will increase conservation and efficient use of energy in India. The mission of the Bureau of Energy Efficiency is to institutionalise energy efficiency services, enable delivery mechanisms in the country and provide leadership to energy efficiency in all the sectors of the country. Reducing energy intensity in the economy is its primary objective.

Under the BEE's Standards and Labelling (S&L) Programme, appliances are rated on a scale of one to five stars, with the most efficient carrying a five-star label and the least efficient carrying a one-star label. The programme has been developed in a collaborative and consensus-driven approach, with active participation from all the stakeholders.

The objective of this programme is to provide the consumer an informed choice about the energy saving appliances and thereby enhancing the cost-saving potentiality of the marketed household. Along with the fact that this will impact energy savings in the medium and long run, it will also position

Box 3.2: Implementation Process of Indian EE S&L



Note on BEE's Process of Certification of Star Ratings

BEE's S&L process starts with its observation through Technical Committee that some of the equipments are highly energy efficient with respect to equipments of similar nature. The BEE, through the Technical Committee, recommends to the Steering Committee standards for a particular product and, with the approval of the Central Government, a scheme is announced for voluntary labelling. The entire process is a very concentrated process.

Based on the purpose of the standards, consultations are drawn and it is only after this that the standards are put up for recommendation to the Central Government. The process for these standards is being developed with the stakeholders such as manufacturers, components manufacturers, test laboratories, opinion makers such as VOICE, other NGO's, etc.[22]

Initial investigations reveal that BEE's process of certification is based on twin criteria of energy saving and performance. It does not cover safety, aesthetics, and other parameters, which are equally important for consumers. Issues like this needs to be incorporated in the certification procedures.

domestic industry to compete in such markets where norms for energy efficiency are mandatory.

Currently, the S&L scheme is invoked for 12 equipments, of which the first four (mentioned below) have been notified under the mandatory labelling regime effective from January 2010. The scheme for other equipments is currently under the voluntary phase and later, depending upon market transformation, they shall also be notified under the mandatory scheme.

Box 3.3: Home Appliances under BEE's S&L Scheme

Products under Mandatory Labelling	*Products under Voluntary Labelling*
1. Frost Free Refrigerators	1. Direct Cool Refrigerators
2. Tubular Florescent Lamps	2. Induction Motors
3. Room Air-conditioners	3. Agricultural Pump Sets
4. Distribution Transformers	4. Ceiling Fans
	5. LPG Stoves
	6. Electric Geysers
	7. Colour TVs
	8. Washing Machines

BEE starts energy efficiency labels for laptops

Recently, the Bureau of Energy Efficiency (BEE) has launched a voluntary endorsement label — BEE STAR Ver. 1— for notebook computers and laptops, which will indicate that the product is among the most energy-efficient models available in the country.

The label provides an endorsement indicating that a product meets specified criteria of energy efficiency. The purpose of endorsement labelling is to indicate to the consumer that the product saves more energy than similar products in the category.

http://www.thehindubusinessline.com/industry-and-economy/ info-tech/ article1599275.ece

Promotion of Awareness of S&L Programme

The introduction of the S&L programme in home appliances needs active support of consumers and this could be achieved by focused outreach campaigns covering all the major stakeholders in the home appliances industry. On the demand side, these specifically include consumers.

One major tool to achieve this is through creating awareness among appliance users. The BEE has taken a number of initiatives to promote awareness about the meaning and significance of the BEE label among all the stakeholders, including consumers. Various such initiatives taken by BEE

are summarised in the document entitled *Schemes for Promoting Energy Efficiency in India during the XI Plan*. The document states that the consumers have been educated on the cost benefits of buying higher energy efficiency equipment through a multimedia awareness campaign.

A multimedia campaign was launched by the BEE in print and audio visual media to create awareness about energy efficiency and create market for these appliances.

To create awareness about the BEE star-rating label, a half-day workshop on National Educational/Awareness Programme on Standards and Labelling was arranged for sales executives.

The objective of the workshop was to educate the sales executives about the BEE star-rating label and to communicate it to the customers/purchasers by providing necessary information about select energy-efficient products. The scope of these workshops has been expanded to cover all household appliances currently under voluntary/mandatory phase under the BEE S&L programme.

Box 3.4: National Educational/Awareness Programme on Standards and Labelling

During the period, July 2008 to March 2009, the BEE organised 36 National Educational/Awareness Programmes on Standards and Labelling covering all the four regions. Out of the total participants who attended the programme, about 36 percent were from the South, 26 percent from the West, 25 percent from the North and the remaining 13 percent were from the Eastern region of the country. The programme focused on creating awareness about the S&L programme among the dealers of home appliances. And, the programme, during this period, covered a total of 2202 participants.

More than 50 awareness programmes were conducted for consumers and sales representatives. According to the 2009 outreach document of BEE, to increase the awareness level about BEE star-labelled products amongst channel partners, the National Educational and Training programme (NETP) was initiated for 'Point of Sales Persons' of Channel Partners, who are dealing with consumers on a day to day basis for selling home appliances. Thirty-seven programmes covering the entire country have been conducted and more than 2202 retailers have been trained.

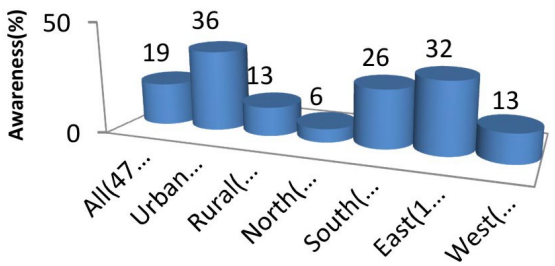
The performance of the outreach programme has significantly improved over the last few years. This is reflected by the BEE's outreach document, which shows that, when the programme was launched at Chennai in the middle of 2008, only seven participants attended the programme. This was despite the fact that the programme was advertised through print media, covering all national leading newspapers and circulated via regular e-mail communication by the officer in-charge to all concerned manufacturers to depute sales executives to attend the programme.

But, in the later period, the situation improved and a higher participation was recorded. The last programme at Ludhiana ended with a good number of participants, numbering 125. Though there is no data to show the reasons for this improved participation, better coordination with producers and traders can be argued to be one of the reasons.

Awareness of the BEE Labelling Programme in India

Increasing awareness about the BEE's labelling programme is helping the market of energy-efficient products to grow impressively. BEE's awareness-raising campaigns have now become more visible. Studies conducted show that now people are accepting energy-efficient appliances more than the earlier years of BEE's S&L programme. The current status of

Figure 3.1: Awareness of the BEE Labelling Programme in India



Source: http://eneken.ieej.or.jp/data/3694.pdf

awareness and how the market for energy efficient appliances is getting transformed are enumerated in Figure 3.1.

Existing data shows that only 19 percent people in the country are aware of the BEE's labelling programme. The awareness is much higher in urban areas, as compared to rural areas. What is, however, surprising is the fact that the level of awareness in the northern and western parts of India are significantly lower than that of the eastern and southern parts.

Overall Effectiveness of the S&L Programme

Overall impact of a programme can be assessed by measuring the success of the programme in terms of its set objectives. BEE's S&L programme likewise has the objective of promoting the sales of energy-efficient appliances to reduce energy consumption, on the one hand, and to reduce emission of CO_2, on the other hand. Data on sales of these products show that the country has started reaping the benefits of BEE's S&L programme, both in terms of energy savings and reduced CO_2 emissions. Sales of energy-efficient appliances are increasing every year in almost all the product categories.

There is, so far, very limited analysis of the effectiveness and diffusion of energy efficiency technologies through the

S&L programme in India. An impact analysis of the Standards and Labelling Programme was initiated by the BEE and the status report quotes that the impact of the S&L programme on energy savings for 2007-08 was around 260 MW and which has been increased to 599.44 MW during the year 2008-09. The savings during the year 2008-09 resulted only from efficient products in TFL, refrigerator and AC segments. It increased further to 2179 MW during the year 2009-10. The huge savings are due to market transformation in greener products.

Furthermore, BEELINE (quarterly newsletter of BEE, January 2011) states that, in all, the S&L programme has resulted in electricity saving of 4350.92 million units, equivalent to avoided generation capacity of 2179.31 MW.

Out of the eight products shown below, AC appears to make the highest contribution in capacity avoided and accounts for about two-third of the total capacity avoided. It is distantly followed by refrigerators and tube lights. One important development that has come up as a result of the progress made by the S&L programme is that, lately, the contribution of Five-Star-labelled products is increasing at a relatively faster pace than lower label products.

However, Three-Star-labelled products have the largest share in avoided capacity, as shown below (Table 3.2). It accounts for more than one-third of the total avoided capacity, followed by Five-Star and Two-Star-labelled products. Another important development is that the contribution of One and Two-Star-labelled products is negligible in all the products categories, except for air conditioners.

This indicates that the impact of the S&L programme on avoided capacity will become deeper and more effective in the coming periods. Product-wise estimate of avoided capacity is given in Annexure: 3.1 to 3.7.

Table 3.2: Estimated Energy Saving because of the Use of BEE's Labelled Products *(Megawatts)*

S. No.	Product*	1 Star	2 Stars	3 Stars	4 Stars	5 Stars	**Total**	Product-wise share (%)
1	AC	125.4	483.3	524.3	74.2	248.8	1455.9	**67.0**
2	DCR	0	0.4	59.8	98.2	159.2	317.5	**14.6**
3	FFR	0	0	13.4	76.6	73.2	163.2	**7.5**
4	FTL	0	0	137.2	0	23.1	160.3	**7.4**
5	CTV	0	0	2.1	9.3	15.6	27.0	**1.2**
6	CF	0	0	0.1	0.1	1.4	1.7	**0.1**
7	SWH	0	0.1	0.1	3.3	1.3	4.8	**0.2**
8	AGPS	0	0	0.1	0.2	41.9	42.3	**1.9**
Total		125.4	483.8	737.1	261.9	564.5	2172.6	**100.0**
Star-wise share (%)		**5.8**	**22.3**	**33.9**	**12.1**	**26.0**	**100.0**	

* Abbreviations: AC: Air Conditioners; DCR: Direct Cool Refrigerators; FFR: Frost Free Refrigerators; FTL: Fluorescent Tube Lights (36 Watts); CTV: Colour Television; CF: Ceiling Fans; SWH: Storage Water Heaters; and AGPS: Agricultural Pump Sets.

Two important observations can be made from Tables 3.2 and 3.3. In terms of avoided capacity, air conditioners appear to have a bigger role to play than all the other product segments. This is because of the relatively higher energy-saving capacity of energy-efficient air conditioners, which varies in the range of 125 MW (One Star) to 249 (Five Star).

In the case of reduction in CO_2 emissions, the situation is different. Refrigerators (direct cool and frost free) have the largest contribution and thus could have higher future potential. They accounted for over 60 percent in total reduction in CO_2 arising from the BEE's labelled products. It is distantly followed by air conditioners (20 percent) and others.

This could be on account of two factors: firstly, the number of energy-efficient refrigerators sold annually is much higher that air conditioners; and, secondly, relatively higher annual refrigerant leakage rate.

In terms of cost savings, refrigerators (direct cool and frost free together) contribute to more than 60 percent, as in the case of CO_2 reduction.

Table 3.3: Impact of S&L Programme (2009-10)

S. No.	Product Name	Annual Production/ Sales	Savings in MU	Cost Saving*	CO_2 Reduction (Tonnes)	Product-wise CO_2 Reduction (%)
1.	Direct Cool Refrigerators	4812741	1737.78	695.1 (40)	140,7601	40.0
2.	Frost Free Refrigerators	1594802	892.05	356.8 (20)	722,560	20.5
3.	Room Air Conditioners	2232603	1090.18	436.0 (25)	882,090	25.0
4.	Colour Television Sets	1763849	147.38	58.9 (3.4)	119,377	3.4
5.	Distribution Transformers	51612	45.77	18.3 (1.1)	37,073	1.1
6.	Ceiling Fans	253886	9.272	3.7 (0.2)	7,508	0.2
7.	Storage Water Heaters	199814	25.98	10.3 (0.6)	21,043	0.6
8.	Tubular Fluorescent Lamps (36 Watts)	35728733	171.49	68.5 (3.9)	138,510	3.9
9.	Agricultural Pump Sets	69254	230.99	92.4 (5.3)	187,101	5.3
	TOTAL		**4350.92**	**1740**	**3,522,863**	**100.0**

Note: Figures in parentheses indicate share of each product category in total cost savings.
*Cost savings in ₹. In crores based on an average of ₹4 per unit.
Source: http://www.bee-india.nic.in/BEE%20Newsletter%20Oct%202010%20new.pdf

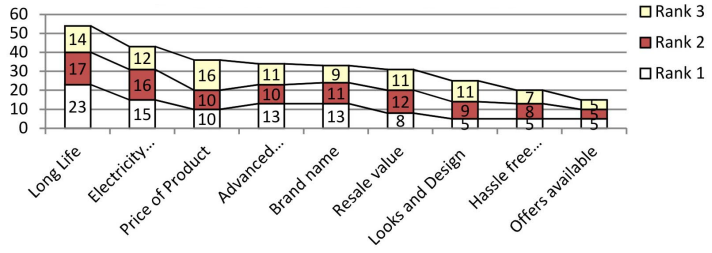
Market Transformation of Refrigerators and Air Conditioners

There are indications that the Indian home appliance market for some products is under complete transformation. This ongoing transformation is further helping the consumers to go for greener products. In a sense, a new chain reaction –

one purchase leading to another purchase – has come into offing. Data indicate that, in comparison to the preceding two years, the production for the Five-Star rated models has increased by more than 40 percent in the year 2009-2010.

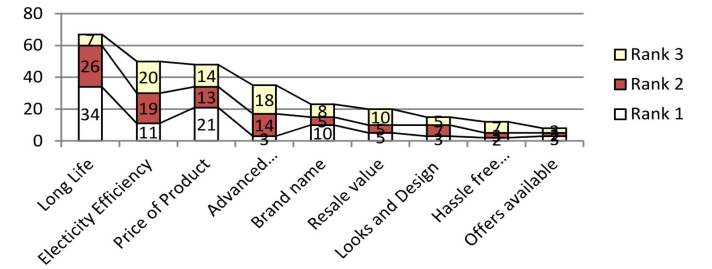
Also, the maximum number of products sold in the year 2009-10 are under the Five-Star category, thus resulting in a market shift towards more efficient appliances. A report indicates that electricity efficiency of products such as refrigerators and air conditioners, in terms of consumers' ranking for factors that influence purchase decisions, is placed at the second position after product life.[23]

Figure 3.2: Ranking Factors for Purchase of Refrigerators (%)



Source: Alvin Jose TERI/BEE, Energy Efficiency Standards and Labelling in India, 2011.
http://eneken.ieej.or.jp/data/3694.pdf accessed on July 16,2011

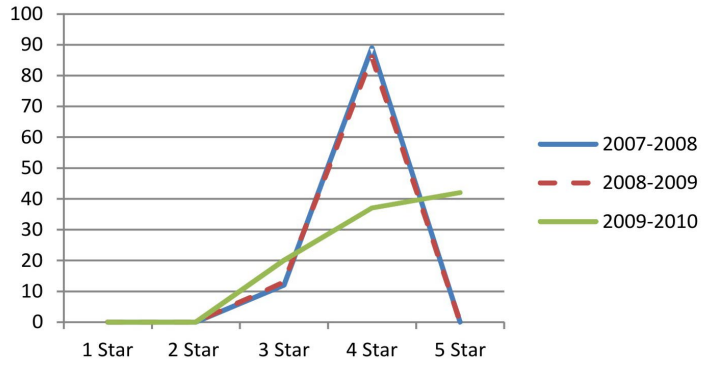
Figure 3.3: Ranking Factors for Purchase of Air Conditioners (%)



Source: Alvin Jose TERI/BEE, Energy Efficiency Standards and Labelling in India, 2011.
http://eneken.ieej.or.jp/data/3694.pdf accessed on July 16,2011

This is reflected by the sales patterns of energy-efficient products. Data show that sales of energy-efficient refrigerators have increased significantly over the last three years. While during 2007-08 and 2008-09 Four-Star products realised the highest share in sales of labelled products, there is a clear shift in 2009-10. Five-Star-labelled products have gained the highest share. This is indicative of consumers' increasing preference for Five-Star-labelled refrigerators.

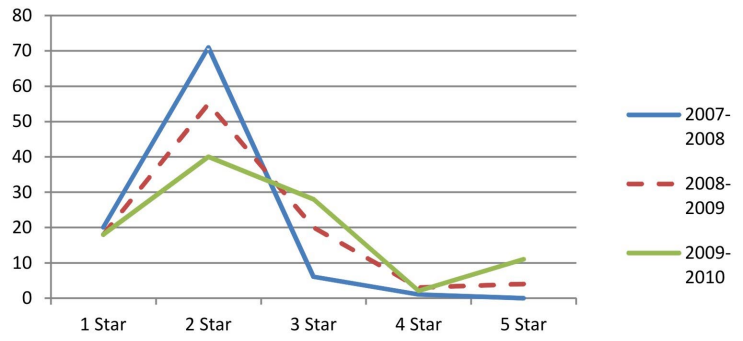
Figure 3.4: Market Transformation in Refrigerators Star-rated Products (Labeled Production in %)



Source: Alvin Jose TERI/BEE, Energy Efficiency Standards and Labelling in India, 2011. http://eneken.ieej.or.jp/data/3694.pdf accessed on July 16,2011

Contrary to the above observations, in the case of air conditioners, a different trend is observed. Sales of Five-Star-labelled air conditioners are yet to pick up. Their share is much below the Two-Star and One-Star-labelled products. It is also observed that its share till 2009-10 has remained confined to around the 10-percent mark. However, one heartening feature of its sales trend is that its share has consistently increased during the three-year periods.

Figure 3.5: Market Transformation in Air Conditioners Star-rated Products (Labelled Production in %)



Source: Alvin Jose TERI/BEE, Energy Efficiency Standards and Labelling in India, 2011. http://eneken.ieej.or.jp/data/3694.pdf accessed on July 16,2011

Table 3.4: Equipment /Appliances Expected to be in Indian S&L Programme in the Near Future

Home Appliances ✓ Electronic Ballast ✓ Computer Monitors ✓ Kerosene Stoves ✓ Consumer Electronics	Industrial Appliances ✓ Industrial Fans and Blowers ✓ Diesel Generating Sets ✓ Boilers ✓ Compressors
Other Appliances ✓ Uninterrupted Power Supply(UPS) ✓ External Power Supplies ✓ Battery Chargers ✓ Standby Power Equipments ✓ Vehicles	Refrigerators and AC Systems ✓ Adaptive Defrost ✓ Commercial Freezers ✓ Visi Coolers ✓ Chocolate Coolers ✓ Chest Control ✓ Heat Pumps ✓ Multi-split Systems

Alvin Jose TERI/BEE, Energy Efficiency Standards and Labelling in India, 2011 http://eneken.ieej.or.jp/data/3694.pdf accessed on July 16,2011.
Source: CLASP-BEE Report 2009.

Encouraged by the current developments – producers' and consumers' responses – the BEE is considering bringing in more products in the labelling programme in the future, as indicated by the Table below. The proposed list for labelling includes electrical and other types of appliances, both for household and industrial uses.

Scope and Potential of Energy-efficient Appliances

Data indicate that India has done reasonably well within a short period of time. The achievements are impressive, considering that the S&L programme is only five years old. However, one can also say that this is just a good beginning and a lot more can be done. The nation has a huge scope and potential for energy-efficient appliances. Initiatives to extend the coverage could have a deeper impact for energy-efficient products. The same is reflected in various studies.

Studies indicate that about one-fifth of the general public is aware about the BEE labelling programme and this

Box 3.5
Progress of S&L in Air conditioning Segment
In the air conditioner segment, as per available data, the BEE has approved 321 models from different consumer appliance companies under the S&L programme. Out of these, about 75 percent are in the split segment, while the remaining is in the window segment.
Progress of S&L in Refrigerator Segment
In the refrigerator segment, as per available data, the BEE has approved 472 models from different consumer appliance companies under the S&L programme. Out of these, about 57 percent are in the frost free segment, while the remaining 43 percent are in the direct cool segment.

awareness is much higher in urban areas, when compared with rural areas (Jose, 2011). The level of awareness among recent purchasers of refrigerators and air conditioners is also found to be on the upswing. However, these findings with respect to air conditioners and refrigerators are in vast contrast with the findings of The Energy Resources Institute (TERI 2007). According to that study, awareness with respect to energy-saving options in space conditioning was low. Majority of the consumers were unaware about star ratings in both these products.

A sustained S&L programme and the potential to increase the number of products in the S&L list can be expected to make a significant contribution in achieving both – energy saving and CO_2 reduction. Estimated savings potential from five main products is reflected in Table 3.5. The combined potential savings from five products are projected to increase by more than three times during 2011 to 2015 and about 10 times during 2011 to 2020.

When it comes to bulbs and lighting, compact fluorescent lamps (CFLs), also known as a compact fluorescent light or

Table 3.5: Estimated Potential Savings – Impact of S&L Programme

S. No	Particulars	Energy Savings Potential (MW)			
		2007	2011	2015	2020
1	Refrigerators (Frost Free)	10	138	645	1930
2	Refrigerators (Direct Cool)	24	232	662	1671
3	Refrigerators (All)	35	370	1307	3601
4	TFL	66	138	286	711
5	ACs	7	98	424	1776
6.	Total (5 products)	142	976	3324	9689

Source: petrofed.winwinhosting.net/upload/5June08/.../Sanjeep%20garg_BEE.ppt

energy saving light, are being heavily promoted as energy saving alternatives to incandescent lamps. According to Steve and Wayne (2009), CFLs provide similar light quantity and quality, while only requiring about 20-30 percent of the energy of comparable incandescent lamps. In addition, CFLs last 7 to 10 times longer than their incandescent counterparts. In many cases, it is cost-effective to replace an entire incandescent fixture with a fixture specially designed for CFLs. Reddy (2003) in his paper estimates that the switch from a kerosene lamp to a 13 watt CFL would pay for itself in less than one year.

Currently, it is observed that many CFLs are commercially available. However, their sales are low. Based on survey data, Reddy and Shrestha (1998) find that lack of awareness, uncertainty and high initial costs are major factors leading to lower rates of adoption of more efficient lighting systems.

Box 3.6: The Bharat Bachat Lamp Yojana: A Unique Energy Saving Initiative

The BEE, in partnership with DISCOMs, introduced the programme in early 2009 to supply households with CFLs voluntarily. This is the first and largest Programme of Action from India and is registered by the UNFCCC. Under this program, CFLs are distributed to households in exchange of incandescent lamps (ICL of 40W, 60W and 100W) at a cost of ₹15 per CFL.

The programme, which seeks to replace estimated 400 million incandescent bulbs and which is still in progress, is expected to reduce estimated 6000MW of electricity generation capacity, translating into a potential saving of ₹240 billion by 2012. In addition, there would a combined Green House Gas emission savings and this will result in reducing 20 million tonnes of CO_2 from grid connected power plants.

Kumar et al. (2003), using a survey administered to 900 households in Delhi, find that awareness of CFLs among consumers, especially those with monthly family incomes lower than ₹10,000, is very low. CFL use was low even among consumers who were aware of them. The high price and lack of warranty appear to explain the low acceptability of CFLs. The findings were almost same in another survey conducted by TERI (2007) where it gauges the awareness about the CFL scheme among the residents in Delhi.

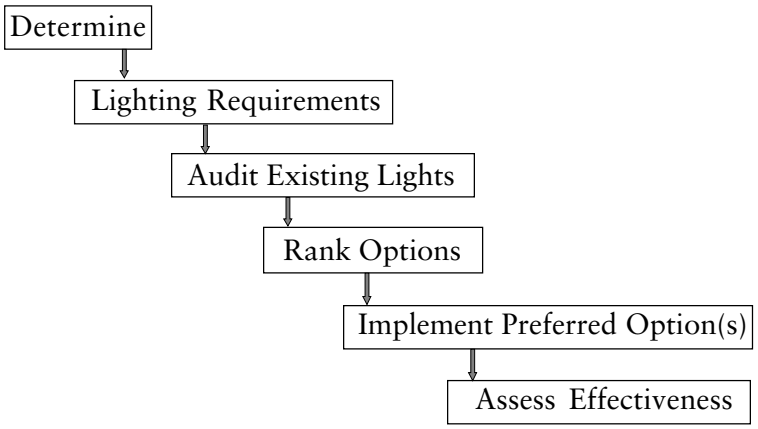
The Electric Lamp and Components Manufacturers Association of India has claimed that, in India, barely five percent of the population knew about CFL lamps, while in Australia, 80 percent was aware about CFL lamps. However, there is no reference in its presentation as to who conducted this survey and where and when they conducted it. The reasons stated for such low awareness of CFL lamps are that retailers are not taking care to explain to consumers the cost benefits in the long term, inadequate public education programme by the government and industry advertisements proclaiming only 80 percent power saving.

In contrast to the above claim, a case study by TERI (2007) points out that nearly 85 percent of the households in the surveyed sample were aware of energy saving options in lighting and have taken required measures in this aspect.

While 26 percent have replaced one or more bulbs with CFLs, 29 percent used their lighting appliances carefully to avoid wastage of electricity. Likewise, 30 percent used tube lights with electronic ballast and 15 percent of the households have not taken any of the measures. Out of this 15 percent, 12 percent were not aware and three percent were not keen on adopting such measures.

With respect to water heating, the case study concludes that 68 percent of the households use water heating appliances carefully to avoid wastage of electricity, while 32 percent of

Box 3.7: Steps to Attain Energy Efficiency in Lighting



the households have not taken any measures. Also, the study summarises by saying that it is evident from the analysis that there exists a high level of awareness among the respondents about efficiency options in lighting. However, in the case of water heating and other end uses (like use of washing machine, space conditioning and so on), awareness is very low. Some reasons given for this are high initial cost, unavailability of financing schemes and resistance to change. Another key reason quoted is lack of interest among consumers, which is primarily because of uncertainty regarding savings.

Regarding awareness of producers about consumer attitude, the case study by TERI highlights that, owing to a low demand in the market, manufacturers are reluctant to manufacture energy-efficient appliances.

Consumers, despite being aware of such options, are not able to obtain these equipments conveniently from the market. There are limited incentives from the government in terms of providing relaxation in excise duty to manufacturers and encouragement to consumers. All these factors contribute to the vicious cycle that restricts the penetration of energy-

efficient appliances. These also show that, once these issues are addressed, the potential of energy savings and reducing CO_2 emission could be realised.

Barriers Restricting Awareness of Energy-Efficient Appliances

There are some key barriers to widespread commercialisation of energy-efficient appliances in India (Tanmay Tathagat, 2007).

- These include policy barriers (lack of institutional capacity to implement energy efficiency programmes in the end use sector, as EE of appliances is not given due consideration at the fiscal policy level);
- finance barriers (price sensitivity of the appliance market, no willingness/incentive for manufacturers to invest in energy efficiency, lack of associated financial incentives and mechanisms to promote wider availability of energy efficient products, lack of resources for design development and testing especially amongst small scale manufacturers);
- business and management barriers (manufacturers' uncertainty about market demand of high efficiency models, lack of resources amongst small-scale manufacturers and informal assemblers);
- information barriers (lack of awareness about residential energy end use, both at the consumer as well as government level, lack of awareness about energy saving potential through appliance energy efficiency programmes, lack of information about state-of-the-art design and manufacturing of EE appliances); and
- technology barriers (lack of access to the state-of-the-art energy efficiency technology, lack of EE-driven applied R&D, lack of state-of-the-art testing capability and trained testing engineers).

To address these barriers and promote a sustainable pattern of energy use in India, an integrated market transformation programme is required with a combination of both regulatory and market based activities. This will require greater policy support for the S&L programme (inline departments/ministries coming together to devise ways and means to generate awareness; bringing in greater transparency in decision-making, facilitating wider dissemination of EE technology, building technical capacity within the country for testing, and building a strong institutional structure for developing and implementing the programme); involvement of all the stakeholders; and support from international agencies.

Likewise, Sood (2009) highlighted the following barriers to energy efficiency:

- Lack of proliferation of demand-side management (DSM) projects and concepts;
- Lack of information about comparative energy use, especially of appliances bought by retail consumers;
- Perceived risk due to lack of confidence in the performance of new technologies – in appliances, building design, industrial technologies;
- Higher cost of energy-efficient technologies; and
- Asymmetry in sharing of costs and benefits – especially in the buildings sector.

Box 3.8: Stakeholders Who Can Influence Drive for Energy Efficiency in India

- The judiciary
- Central and State Governments
- Unions and other political interest groups
- The environment lobby
- Think tanks
- Energy research institutions
- Domestic and international financial institutions
- Media and CSOs

All these were also highlighted by Reddy (1990), wherein he states that the barriers to energy efficiency improvements are due to ignorance, cost sensitiveness, indifferent consumers' attitudes, helplessness, uncertainty in decision-making and the poor being inheritors of inefficiency. In the case of end use equipment manufacturers and providers, barriers arise due to the efficiency blind[24] and the operating costs blind,[25] respectively.

Bhattacharya and Cropper (2010) state that the diffusion of energy-efficient technology occurs slowly in both developing and developed countries due to variety of factors. According to them, the fundamental barrier is government policies that distort prices.

Sathaye et al. (2005) provide another example with respect to the agriculture sector. They state that the energy efficiency of agricultural pump sets in India is extremely low and the reason behind this is the policy that heavily subsidises electricity use for farmers. Replacing most pump sets would be fully cost-effective, if electricity were priced at marginal cost. However, the subsidies to electricity have prevented their replacement.

Need for Action Research

There is a lot of literature available on the need for generating awareness and the barriers which restrict the actual use of energy-efficient products in India. However, there are virtually no such studies focusing on India that analyse the awareness level of energy efficiency or studies which document the actual level of use of energy-efficient appliances.

Such studies would provide useful information about the impact of changes in energy prices, energy efficiency standards and technology adoption subsidies. All these changes in energy markets and policies will continue to have an important influence on energy costs in India and the country's CO_2 emissions.

Annexure 3.1: Energy Savings by Star-labelled Air Conditioners (2009-10)			
Category	AS PER NPC		
	Total BEE Labelled Products	Avoided Capacity (MW)	Energy Saving (MWh)
1 Star	361703	125.37	93878.44
2 Stars	871288	483.26	361866.72
3 Stars	692482	524.25	392559.99
4 Stars	70496	74.2	55562.49
5 Stars	236634	248.81	186312.5
Total	2232603	1455.89	1090180.14
Source: www.bee.gov.in			

- Total number of star labelled air conditioners sold is over 2.2 million units.
- The estimated energy savings due to star labelled Air-conditioner is 1090.18 MU. The corresponding reduction in avoided generation capacity is 1455.89 MW.

Annexure 3.2a: Direct Cool Refrigerators			
Category	AS PER NPC		
	Total BEE Labelled Products	Avoided Capacity (MW)	Energy Saving (MWh)
1 Star	0	0	0.000
2 Stars	9699	0.37	1997.8
3 Stars	1156411	59.8	326911.24
4 Stars	1523847	98.18	536670.06
5 Stars	2122784	159.16	872208.94
Total	4812741	317.51	1737788.04
Source: www.bee.gov.in			

- Total number of star-labelled Direct Cool Refrigerator sold is over 4.8 million units.
- The estimated energy savings due to star-labelled Direct Cool Refrigerator is 1737.78 MU. The corresponding reduction in avoided generation capacity is 317.51 MW.

Annexure 3.2b: Frost-Free Refrigerators			
Category	**AS PER NPC**		
	Total BEE Labelled Products	**Avoided Capacity (MW)**	**Energy Saving (MWh)**
1 Star	0	0	0.00
2 Stars	0	0	0.00
3 Stars	183157	13.452	73364.84
4 Stars	764594	76.55	418446.24
5 Stars	647051	73.22	400245.46
Total	1594802	163.22	892056.54
Source: www.bee.gov.in			

- Total number of star-labelled frost-free refrigerators sold is over 1.59 million units.
- The estimated energy savings due to star-labelled refrigerators is 892.056 million units of electricity. The corresponding reduction in avoided generation capacity is 163.22 MW.

Annexure 3.3: Energy Savings by Star-labelled Fluorescent Tube Lights (FTLs) – 36 Watts (2009-10)			
Category	**AS PER NPC**		
	Total BEE Labelled Products	**Avoided Capacity (MW)**	**Energy Saving (MWh)**
1 Star	0	0	0.000
2 Stars	0	0	0.000
3 Stars	30577266	137.2	146770.876
4 Stars	0	0	0.000
5 Stars	5151467	23.11	24727.04
Total	35728733	160.30	171497.916
Source: www.bee.gov.in			

- Total number of star-labelled FTLs sold is over 35 million units. The estimated annual energy savings due to star-labelled FTLs is 171.49 MU and the corresponding avoided generation capacity is 160.3 MW.

Annexure 3.4: Energy Savings by Star-labelled Colour Television (2009-10)			
Category	**AS PER NPC**		
	Total BEE Labelled Products	**Avoided Capacity (MW)**	**Energy Saving (MWh)**
1 Star	0	0.000	0
2 Stars	0	0.000	0
3 Stars	320765	2.101	11487.406
4 Stars	719919	9.286	50761.594
5 Stars	723165	15.574	85131.84
Total	1763849	26.961	147380.84
Source: www.bee.gov.in			

- Total number of star-labelled colour televisions sold is over 1.7 million units. The estimated annual energy

savings due to star-labelled colour television is 147.38 MU and the corresponding avoided generation capacity is 26.96 MW.

Annexure 3.5: Energy Savings by Star-labelled Ceiling Fans (2009-10)			
Category	**AS PER NPC**		
	Total BEE Labelled Products	**Avoided Capacity (MW)**	**Energy Saving (MWh)**
1 Star	0	0.00	0
2 Stars	0	0.00	0
3 Stars	64531	0.152	831.64
4 Stars	29290	0.136	744.31
5 Stars	159245	1.408	7696.52
Total	253886	1.696	9272.47
Source: www.bee.gov.in			

- Total number of star-labelled ceiling fans sold is over 0.25 million units. The estimated annual energy savings due to star-labelled ceiling fans is 9.272 MU and the corresponding avoided generation capacity is 1.69 MW.

Annexure 3.6: Energy Savings by Star-labelled Storage Water Heaters (2009-10)			
Category	**AS PER NPC**		
	Total BEE Labelled Products	**Avoided Capacity (MW)**	**Energy Saving (MWh)**
1 Star	1280	0	0
2 Stars	10189	0.104	569.069
3 Stars	2666	0.043	237.425
4 Stars	140041	3.328	18192.356
5 Stars	45638	1.277	6982.208
Total	199814	4.752	25981.058
Source: www.bee.gov.in			

- Total number of star-labelled storage water heaters sold is over 0.19 million units. The estimated annual energy savings due to star-labelled storage water heaters is 25.9 MU and the corresponding avoided generation capacity is 4.75 MW.

Annexure 3.7: Energy Savings by Star-labelled Agricultural Pump Sets (2009-10)

Category	AS PER NPC		
	Total BEE Labelled Products	Avoided Capacity (MW)	Energy Saving (MWh)
1 Star	4	0	0
2 Stars	306	0.022	120.481
3 Stars	252	0.09	495.095
4 Stars	1174	0.252	1379.948
5 Stars	67518	41.892	228994.726
Total	69254	42.256	230990.25

Source: www.bee.gov.in

- Total number of star-labelled agricultural pump sets sold is over 69 thousand units. The estimated annual energy savings due to star-labelled agricultural pump sets is 230.99 MU and the corresponding avoided generation capacity is 42.25 MW.

Chapter 4

A Review of Producer and Consumer Responses to S&L Programme, with Special Reference to India

Producer Behaviour in the Context of Energy Efficiency

Over the last two decades, and more specifically in the last decade, corporate initiatives for energy efficiency have gotten more streamlined. Producers encouraged by government initiatives and consumers' positive responses are now giving significant weightage to production of energy-efficient products. This is reflected in growing sales and popularisation of energy efficient products throughout the world.

A large number of countries – both developed and developing – have introduced energy efficiency standards and labelling programme all over the world. These are focused on reducing energy consumption of households. The list provided below shows the ongoing development in the area. Standards and labelling programmes at the country level basically consist of two broad categories: mandatory and voluntary. Voluntary is a step towards moving into mandatory labels. These, duly

Table 4.1: Summary of Labelling Programme in Some Selected Countries[26]

Product	Australia	Canada	Chile	China	HongKong	India	Indonesia	Japan	Malaysia	Mexico	NewZealand	Korea	Russia	Singapore	Chinese Taipei	Thailand	The Philippines	The United States
Air Conditioners-room	M	M V	M	M V	M V	M	V	M V	V	M V	M V	M V		M	M V	M V	M	M V
Air Conditioners-Central	M V	V		M				M V		M V	M V							M V
Refrigerators/freezers-Household	M	M V	M	M	M V	M	V	M V	V	M V	M V	M	U V	M	M	M V	M	M V
Compact Fluorescent Lamps		V	M	M	M V			M V		V	V	V			U V	V	M V	M V
HID Lamps				M	V					V		V					M	M
Ceiling Fans		V				V												M V
Lighting Sensor Equipment										V		V						
Ballasts		V			V				V	V		M	V			V	M V	
Computers	V	V			V			M V		M	V	M	V					V
Monitors	U V			M	V			V		V	V	M	V		V	V		V
Televisions	M	U V		M	V	V	V	M V	V	M V	V	M	V		V	V		M V
Clothes washers	M	M V		M	V M					M V	M V	M			V			M V
Clothes Dryer	M	M									M			M	V			
Water Heater-Electric		V		M	V			U		V	V	M			V			M V

Legend: M-Mandatory Label, V-Voluntary Label and U-Under Development.
Note: The list is modified and also includes the progress of S&L programme in India. Countries such as Brunei, Darussalam, Papua New Guinea and Peru originally covered in the report have been excluded.

supported by companies, are, in fact, reshaping the home appliance market.

The most glaring example is that of CFL, for which the high purchase cost held back the market penetration of CFL initially. To overcome this market barrier, almost all major economies have introduced MEPS (minimum energy performance standards) for lamps which have had the effect of a ban on incandescent lights. Examples of these policies include:

- European Union: progressive phase out of incandescent light bulbs from 2009 to 2012;
- Japan: progressive phase out of incandescent light bulbs by 2012; and
- Brazil: progressive phase out of incandescent light bulbs starting in 2010.

Canada, Australia, Korea and Switzerland have also announced a policy of phasing out incandescent lamps. China and India are considering a phase out of incandescent lamps. To realise the full potential from energy savings as a result of switching to energy-efficient CFLs, the phase out policies formulated worldwide need to be vigorously enforced in the coming years.

Country Level Producer Response to Energy Efficiency Drives

A number of corporate activities relating to energy efficiency are currently observed in different countries. This includes both developed and developing countries such as the US, China and India.

Samsung is producing and promoting energy-efficient Energy Star products that help consumers join in the effort to increase energy efficiency and reduce emissions of greenhouse gases.

In the US, it offers more than 900 Energy Star qualified models across multiple product categories, including more televisions than all other consumer electronics brands. The company was recently named 2011 Energy Star Partner of the Year in the Product Manufacturing Category by the US Environmental Protection Agency (EPA). Samsung was selected from 20,000 participating Energy Star organisations for its outstanding contributions in consumer education campaigns, recycling efforts and labelling practices, besides others.

Based on such initiatives by producing companies, Americans prevented 170 million metric tonnes of GHG emissions with the help of Energy Star – equivalent to the annual emissions from 34 million vehicles — and saved US$18bn on their utility bills. Products, homes and buildings that have earned the Energy Star prevent emissions by meeting strict Energy Efficiency specifications set by the EPA.

China is also pushing its energy efficiency drives in a big way. Its energy efficiency drive is premised on product standards and laws, including the Energy Conservation Law of 1998. The law emphasises the need for both minimum efficiency standards and appliance labels. By 1999, the arrival of a new approach to appliance energy efficiency was marked by the government's release of revised standards and new voluntary labelling criteria for refrigerators and air conditioners.

Producers have responded well to standards requirements. They now cover more than 20 types of major products, including most residential and commercial appliances. In recent years, the country has been developing two-tiered reach standards that require them to meet more stringent requirements over time. Unlike both the mandatory standard and the voluntary energy efficiency labels, manufacturers are able to self-report the energy consumption of each model.

The process of product up-gradation has started in India in a big way. Consumers have now started thinking of replacing their old non energy-efficient products with efficient ones. Indian consumers have started upgrading to higher priced less power-consuming air conditioners to snip mounting electricity bills after the government made it mandatory for appliances to be rated on energy efficiency.

Anecdotal evidence suggests that sale of energy labelled air conditioners is making significant inroads in the Indian market. Even though most consumers are opting for products with three stars, demand for a Five-Star product is catching up, as its running cost is lower and it helps consumers save money on electricity bills.

Data also demonstrate that Five-Star rated ACs with lowest power consumption accounted for a third of the total sales of leading companies such as LG, Samsung, Voltas, Carrier and Godrej in 2010, compared to just 5-10 percent in 2009. Purchase of these products, though mostly confined to cities, is also increasing in the rural and semi-urban markets.

What is more important is the fact that the trend is tilting in favour of energy-efficient products, a good sign for energy efficiency drive in the country. The market size of AC in India, estimated at 2.5 million units in 2009, was expected to grow by 40 percent, to reach 3.5 million units in 2010. It is very important from energy efficiency point of view that India is really in a position to save electricity on all the newly sold air conditioners

LG Electronics has enhanced energy-efficient refrigerators by applying advanced technologies. The initiative contributes to reducing carbon dioxide emissions from the demand-side by consuming less energy from refrigerator use.

Also, the electricity consumption of both Direct Cool and Frost Free refrigerators has decreased over the period of 10 years. The company has been launching one or two pilot model platforms annually for higher energy efficiency, since majority

of Indian customers are more price-conscious, as opposed to energy-conscious.

Many consumer electronics companies in India, including Godrej and Haier, are taking initiatives to address the issue of energy efficiency in home appliances. These companies are working on a strategy to make their entire product portfolio energy-efficient. They are also in the process of rolling out a product-recycling initiative and reducing use of hazardous materials and components in their manufacturing process. Such initiatives have the potential to transform consumer consciousness towards environment-friendly products in India, especially in the urban markets.

It is believed that increasing green footprint will help improve their brand equity, especially because e-waste is becoming a major issue in India. It will also help expand their market, as consumers are now increasingly becoming eco and energy-conscious.

Consumer Behaviour with regard to Income Constraint and Price-level Changes

Consumer behaviour and consumption patterns evolve over time. These are impacted by multiple factors, including level of awareness and willingness to pay a premium for energy-efficient products. These, in turn, are influenced by income level, consumer's location, rural-urban divide, gender, product's easy availability and accessibility and others. According to a report published by United Nations[27], a household's energy consumption is determined by five key factors. These include:

- Prices of appliances;
- Disposable income of households;
- Availability of appliances;
- Particular household's product requirements; and
- Cultural preferences.

Past experience shows that consumer purchase decision for energy efficiency products can be motivated by a well-designed programme, including rebates, publicity and assistance in disposing of old appliances. Though in a different context, a study on green-labelled milk by Wei Xia, Yinchu Zeng[28] demonstrated that the majority of households are quite familiar with green food and most of them take positive attitudes towards them, but with certain anxieties.

Both remarkable preferences for location and branding in milk purchase and neglect for quality and safety are found in a consumer's purchase pattern. The willingness to pay (WTP) is concentrated in a range of 5-10 percent premium than ordinary milk. Consumer's age, his perception of green food and access to information serve as the main factors influencing WTP value. This can also hold true in case of home appliances.

According to a study,[29] entitled Consumer Research on Energy Efficiency and Renewable Energy, general population in the US shows significant preference for energy-efficient products. They also show good understanding for the need of such appliances to address the adverse impacts of climate change. The same is reflected by people's perceptions on energy star-label products, as shown in the Table 4.2.

Table 4.2: Consumers' Attitudes Towards Energy Efficiency

Consumers' Perceptions of Energy Efficiency	**Agree (%)**
It is important for household appliances, electronics, heating and cooling systems and lighting products to have energy star-label	50
The importance of the energy star-label is to save money on energy bill	50
The importance of the energy star-label is to be energy efficient and environmentally-friendly	55

These appear to motivate consumers to replace appliances before the end of the expected life of the appliance. However, the study also indicates that there is little, or no, evidence that consumer tax credits are effective in influencing a significant number of consumers to change their purchasing behaviour. Though energy labels and the US EPA's energy star logo are good indicators of cost-effective and energy-efficient appliances, but the labels in themselves are insufficient to cause substantial change in consumer purchasing practices.

The more successful programmes offer insights that should drive the development of any future programmes with respect to consumers:

- It is much easier to influence consumers who are actively engaged in appliance purchases than to influence the general public.
- Retail appliance salespeople have significant influence on consumer choice. Incentives aimed at the salesperson (rebates by manufacturers to the retailers payable to the floor sales staff in order to encourage the sales staff to

Table 4.3: Preferred Source of Consumer Advice

Source of Advice	Consumer Preference*
Showroom	3.69
Personal Contact	3.41
Magazines	2.88
Newspapers	2.78
TV	2.09
Radio	1.55
Internet	1.54

* Consumer Preference on a scale of 1 to 5, where 5=Most Valuable, 1=Least Valuable

Source: Brown & Whiting: *Consumer Attitudes Toward Energy- Efficient Appliances,* adapted from *Appliances and Global Climate Change: Increasing Consumer Participation in Reducing Greenhouse Gases,* http://www.pewclimate.org/docUploads/appliances.pdf accessed on July 16, 2011

promote more efficient appliances), coupled with simple sales tools (such as energy guide brochure), can steer consumers in the direction of energy-efficient appliances.
- Direct financial incentives for consumers may not be necessary.

Women are now playing an important role in the purchase of energy-efficient products. It has already been established by various researches that females, in general, have a greater willingness to pay for eco-labels than males. It is also understood that the public benefits associated with the label are likely to have a greater effect on females than males, while the opposite is true for the private benefits associated with the label.[30]

Individuals with greater levels of concern for the environment had a greater likelihood of using energy-efficient appliances and thus a greater willingness to pay for such appliances.

International Good Practices on Energy Efficiency

Good practices are defined as generally accepted, informally standardised techniques, methods or processes that have proven themselves over time to accomplish given tasks. Often, these practices are used where no specific formal methodology is in place or when the existing methodology does not sufficiently address the issue. The basic idea is that, with proper processes, checks and testing, a desired outcome can be delivered more effectively with fewer problems and unforeseen complications. In addition, a good practice can evolve to become better as improvements are discovered.[31]

Good practices are used to maintain quality as an alternative to mandatory legislated standards and can be based on self-assessment. Best practice is a feature of accredited management standards such as ISO 9000 and ISO 14001.[32]

Good practices usually emerge when the market or a product or service is constrained by either demand or supply-side factors. On the demand side, this constraint might be in the form of lack of product awareness, lack of buying capacity, high cost of using a product, lack of preference and others. On the supply side, the market can be constrained by increasing cost of production and high market price, among others. One important aspect here is that emergence of best practices at either side has influence on both, in fact these are self-reinforcing. These reshape the market in furtherance of societal interests.

Case Studies on Energy Efficiency

Anglo Platinum, South Africa

The company,[33] which is a major producer of Merensky and UG2 ore used in the downstream refining into Platinum, launched a pilot project initially at the group's Amandebult Mine in the Limpopo Province. Under the project, a total of 32403 incandescent lamps and 4200 fluorescent lamps were replaced with CFLs from March 2006 to November 2006.

The replacement resulted in a total saving of 233MW hours. Based on the success achieved, the project was extended to all the other mines in the Anglo Platinum group. In total, 184619 lamps were replaced at the group's Union Mine, Modikwa Mine, Lebowa Mine, Bafokeng Rasimone Platinum Mine and all the Anglo Platinum Mines in Rustenburg. The project was finally completed in April 2009. These helped the group to achieve a total verified saving of 9755MW hours.

Besides reducing electricity costs and energy consumption, the lamps unexpectedly had a long life span. While the previously used incandescent lamps had to be replaced eight times a year, the compact fluorescent lamps had a guaranteed design lifespan of 18000 hours under non-switching conditions. However, the result was more surprising. The CFLs showed

a life span of 40000 hours as these remained in use for 4.5 years. This is significantly exceeding the payback time by more than two years, as widely known.

The success of the Voltex Mine Light resulted in it being used in many more of South Africa's largest mines.

Energy-Efficient Refrigerator Project, China

China undertook the project[34] to reduce energy consumption through promotion of improved refrigerator energy efficiency, thereby contributing to protection of the global environment by reducing carbon dioxide and other greenhouse gas (GHG) emissions. An additional project goal

China Refrigerator Project

To reduce the barriers to the widespread commercialisation of energy-efficient refrigerators in China, the China Refrigerator Project was developed.

The project has various components to promote sales of energy efficient refrigerators, including retailer and salesperson awards, incentive and cash payment programme. In addition, the retailer incentive programme also included a lottery-style award for purchasers. This award was designed to give purchasers an additional incentive to buy energy-efficient refrigerators.

A total of 57 top nationwide retailers were recruited to participate in the programme, all of whom signed contracts committing themselves to achieving programme goals. Participating stores and salespeople achieved sales of over 35,000 top-rated energy-efficient refrigerators. While this number was small, compared to total nationwide refrigerator sales, the programme was able to achieve a per-refrigerator incentive cost that was significantly lower than that achieved in comparable rebate programmes in other countries.

was to take advantage of product and production line modifications through the chlorofluorocarbon (CFC) phase out to introduce energy efficiency modifications. The project began in December 1999 and was completed in mid-2006.

Two types of tools – technology push and demand pull – were used in the project. The first one provided technical training, technical assistance, study tours, incentive programmes for refrigerator and compressor manufacturers and revision of the national energy consumption standard. The second one focused on generation of demand pull forces to increase market demand for energy-efficient refrigerators by enhancing retailers' and consumers' understanding of the benefits of energy efficiency and energy-efficient refrigerators.

As a result of this project, the number of manufacturers producing energy-efficient refrigerators and the production of energy-efficient refrigerator models increased significantly. The programme also resulted in the increase of annual production of energy-efficient refrigerators from about one million in 1999 to 10.7 million in 2004 and over 14 million till June 2005. The average refrigerator energy index improved. Production of super-efficient refrigerators (those at least 60 percent more efficient than the energy efficiency standard) increased from 400 units in 1999 to 3.3 million during the period July 2004 to June 2005.

There are currently 256 models of domestically manufactured energy-efficient refrigerators in the market that meet the energy efficiency requirement of grade 1 of the national standard for refrigerator energy consumption. This is said to be superior to European grade A label.

The project's original target was to promote sales of 20 million energy-efficient refrigerators over a 10-year impact period during and following the project's achievement of market transformation. Based on average efficiency gains of 40 percent relative to the baseline, each energy-efficient

refrigerator sold results in reduction of five tonnes of CO_2 emissions over its lifetime. If current sales levels of over five million energy-efficient refrigerators per year continue (*it might have happened by now*), emission reductions due to market transformation achieved by the project could reach, or exceed, 250 million tonnes of CO_2. The cost associated with emission reduction mechanism will likely be less than US$0.05/tonne CO_2.

The Top-Runner Scheme, Japan

The Top-Runner Scheme[35] was introduced in the Amended Law Concerning the Rational Use of Energy, which came into force in April 1999. The Top-Runner programme was introduced to replace the existing Energy Efficiency standards.

While the Energy Efficiency standards were set at a level slightly above the average of the energy efficiency of each product, under the top-runner programme, the best performing items in their category in the market set the minimum standard for a target year. The programme originally covered 11 items and has since been extended to 18 items, including cars, refrigerators, air conditioners, televisions, copy machines, etc.

The programme requires that if a company cannot achieve the target within a target year, then its name and the product name are made public and a fine is imposed upon the company. However, compliance is evaluated not based on each product, but on products in the same category.

The Top-Runner Scheme has significantly contributed to energy conservation of machinery and equipment in Japan. It worked especially well for gasoline passenger cars. The reasons for success include the following:

- A market mechanism is the driver for the scheme.
- Not too harsh penalties made it possible to set very high targets.
- It works best when combined with tax incentives (as in the case of green taxes for passenger cars).

The New York State 'Great Appliance Swap-Out'

A rebate programme, called 'Great Appliance Swap-Out',[36] for consumers was launched by the New York State in February 2010, through a funding by the American Recovery and Reinvestment Act (ARRA). The programme was designed to provide an incentive for consumers to reduce their energy consumption.

Under the programme, residents were entitled to receive a cash rebate for replacing older appliance(s) with new Energy Star-qualified appliance that meet standards issued by the Consortium of Energy Efficiency (CEE) that were higher than Energy Star standards. This programme also provided additional incentives for consumers who recycle their old appliances to help reduce the impact on landfills.

Customers purchasing appliances qualified for a rebate of US$75 (US$105 with documented recycling) for Energy Star-qualified refrigerators, US$75 (US$100 with documented recycling) for clothes washers and US$50 (US$75 with documented recycling) for freezers. Rebates were also available for dishwashers if these were purchased as part of a three-appliance package (refrigerator, dishwasher, clothes washer, etc.). In such cases, rebates of US$500 rebate (US$555 with documented recycling) were offered.

The programme provided more than US$16mn in rebates, 165,148 households participated across the state. The programme had also active participation from more than 1,000 retailers.

The programme resulted in replacement, purchase and recycle of the following:

- Refrigerators - 80,638 replaced with 57,365 Energy Efficiency models; 71 percent of old ones recycled;
- Clothes washers - 82,616 replaced with 60,453 Energy Efficiency models; 73 percent of old ones recycled;
- Freezers - 4,242 replaced with 2,679; 63 percent of old ones recycled; and

- Dishwashers - 2,370 replaced with 1,142; 48 percent of old ones recycled.

A similar programme called 'Buy Green, Save Green NYS High-Efficiency Appliance Rebate Programme' has been launched (September 2011) recently by The New York State Energy Research and Development Authority (NYSERDA). However, the new programme covers only purchase of high-efficiency Energy Star refrigerators and clothes washers. Under the program, rebates of US$350 for high-efficiency refrigerators and US$250 for high-efficiency clothes washers are available.

As reflected by the case studies above, a number of good practices have evolved for making energy efficiency a resource, developing a cost-effective portfolio of energy efficiency programs for all customer classes, designing and delivering energy efficiency programs that optimise budgets and ensuring that programs deliver results. These practices are based on the experiences of some successful programmes. Moreover, an important feature of such practices is that these could be replicated in other places with similar conditions.

Lessons, Opportunities and Challenges

Although electricity currently accounts for a small share of total household energy consumption, it is the main source of energy for lighting and is predicted to grow six-fold by 2031 (GOI 2006). Out of the total electricity consumption of households, electrical appliances are a major source of household energy consumption, especially in higher-income urban households.

Moreover, the share of electrical appliances in household energy consumption is likely to increase significantly in the future because of growth in per capita income and also because of the Government of India targeting to provide electricity to all villages by 2012 under the 'Power for All' programme.

Box 4.1: How Good Practices Benefit the Society: An Example

An estimate by the Massachusetts Division of Energy Resources shows that its 2002 demand-side management (DSM) programs produced 2,093 jobs, increased disposable income by US$79mn and provided savings to all customers of US$19.4mn due to lower wholesale energy clearing prices (Massachusetts, 2004).

For details, see: http://www.epa.gov/cleanenergy/documents/suca/napee_chap6.pdf

Introducing energy efficient lighting and appliances in the household sector is an important alternative to increasing energy generating capacity, while reducing the growth of carbon dioxide emissions at the same time. It will also be useful in ensuring sustainability of India's economic growth. Promoting energy efficiency in households and their use of electrical appliances are, therefore, critical for success of such an initiative.

To promote energy efficiency, India can draw from the benefits and impacts of best practices that are tested and proven. Most of the best practices, however, are consumer-focused and these need to be facilitated by other stakeholders, including government, researchers, CSOs, and the media.

A number of people in various countries have benefited from these best practices and these practices, if implemented, will benefit other countries, including India. However, the implementation of Energy Efficiency mechanisms and its success requires effective implementation by stakeholders, who shape the energy consumption pattern. Each of these stakeholders may be required to make many decisions relating to major energy-using activities. The stakeholders that can play an effective role in energy saving are:

- Energy consumers (individuals, households, firms, farms, factories, etc.);
- End-use-equipment manufacturers and providers;
- Producers and distributors of energy carriers;
- Actual and potential co-generators;
- Local/national financial institutions;
- Central and State Governments; and
- International aid agencies and multilateral organisations and industrialised countries.

Knitting together identified diverse stakeholders for a common objective might be very challenging. This makes the task of ushering in an era of energy efficiency in India difficult and calls for a multi-pronged approach.

Besides, these are a large number of barriers which could create hindrances in implementing such initiatives. One of the most challenging barriers is lack of awareness among various stakeholders. Consumers, vendors, manufacturers, banks and policy makers often have inadequate information about energy efficiency technologies and their costs and benefits.

As of now in India, a harmonised framework for technologies and source of comprehensive information on energy efficiency does not exist yet. As a consequence, both consumers and manufacturers are often unaware of cost-effective practices and energy-efficient technologies. They are also not aware of the energy demands of their appliances with which to compare new technologies.

According to an IEA estimate, energy consumed by appliances in "standby" mode accounts for somewhere between three and 13 percent of residential electricity demand in OECD countries. Only a few customers or manufacturers realise that the same conveniences could be provided using 75 percent less standby power. Initial investigation under the present study suggests that this also holds true for India.

Some other major barriers which India will face include the following:

Box 4.2: Barriers to Energy Efficiency Drive in India

Financial Barriers
- Expectation for quick payback periods
- Lack of investment capital
- Competing household priorities
- High product costs
- Underdeveloped markets

Institutional Barriers
- Lack of capacity
- Aversion to new technologies
- Lack of dedicated energy management system
- Lack of benchmarking

Technology and Access Barriers
- High technology costs
- Transaction costs or hassle factor
- Lack of infrastructure
- Low quality technologies.

Divergent Actors and Incentives
- Split of incentives
- Differing discount rates and perceptions of risks
- Contradicting need for motivating consumers and producers

Regulatory Barriers
- Lack of integrated inter-departmental/government support
- Perverse utility incentives

In India, some initiatives have already been taken by more than one actor towards achieving energy efficiency in products and processes. It, however, needs to be fully integrated encompassing nodal and inline ministries, consumers, suppliers, researchers, media and CSOs. At the same time, it needs to be realised that the existing consumption pattern has evolved over time and, therefore, it might take its own time to re-evolve itself to fit into the current situation of looming energy scarcity and threats of climate impacts.

Annexure 4.1: Some Good Practices for Electrical Home Appliances

Air Conditioners

- Regulating equipment in the comfort zone (23°C and 27°C)
- Consider the on-off cycles. It is beneficial if the compressor possibly operates with the fewest number of on-off cycles, because each time the AC restarts, it requires more electrical power and causes more wear and tear. Turn off the equipment when it is not in use. Do not leave unnecessary lights turned on. Lamps generate heat when they are turned on, which causes greater power usage by the A/C unit.
- Properly maintain the equipment. Maintenance should be carried out periodically (at least two times per year) to ensure that the condenser, the evaporator and the filters are clean and free of dirt and, to verify that, the refrigerant is properly charged; having too much or too little refrigerant volume means more electricity consumption.
- Choose proper size equipment. Equipment that is too large for the space to be air- conditioned requires a higher initial investment and it will use more electrical power and have elevated energy consumption during operation.
- Buy high quality parts. It is recommended that only good quality parts and components be purchased, preferably original ones, so that the equipment operates efficiently and its useful life is prolonged.
- Use equipment of the same brand. Use of the same brand and model of equipment is preferred to simplify the acquisition and control of the spare parts inventory.
- Replace inefficient equipment. When necessary, replace equipment that is inefficient or that has completed its

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useful life and substitute it with other efficient equipment such as devices with the energy star-label.

- Eliminate air infiltration. Infiltrations of hot air from the outside into the air-conditioned spaces should be reduced as much as possible. A good seal against air leaks in windows and doors will lead to electricity savings from the reduced use of the air-conditioning system.
- Install an extraction hood. Kitchen equipment in air-conditioned spaces should have extraction hoods to remove vapours.
- Set minimum ventilation levels. Outside air ventilation levels should be adjusted to the recommended minimums. Smoking inside acclimatised spaces is not good for cooling.
- Distribute air efficiently. Fans can be used to distribute fresh air throughout internal environments when the air conditioner is operating.
- Automate the AC. Programmable thermostats should be used with the air conditioner to regulate the temperature for times when few people are working, so as not to turn off the equipment completely. In large spaces, equipment that is turned off at midday will have to work at higher power to re-cool the area when the users return. The use of occupancy sensors can help improve AC equipment performance.
- When buying new equipment, take into account the technical standards and energy efficiency labelling for the air-conditioning systems developed in each country, which specify minimum efficiency performance indices and direct one to the acquisition of more efficient equipment.

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Refrigerators

- Look for a refrigerator with automatic moisture control.
- Always cover liquids and wrap foods stored in the refrigerator. Uncovered foods release moisture and make the compressor work harder.
- Make sure your refrigerator door seals are airtight.
- Move refrigerator away from the wall and vacuum the condenser coils once a year, unless you have a no-clean condenser model.
- Regularly defrost manual-defrost refrigerators and freezers. Frost build-up decreases the energy efficiency of the unit. Don't allow frost to build up more than one-quarter of an inch.
- To get the most efficient operation from refrigerator, ensure not to keep the refrigerator or freezer too cold. Evidence suggests that refrigerator works more efficiently at temperatures of 37 to 40 degrees Fahrenheit for the food compartment and five degrees Fahrenheit for the freezer.
- Ensure to use a locally-produced refrigerator, as using a refrigerator designed for other regions in a tropical climate will lead to inefficient use of energy.
- Ensure not to open doors of the refrigerators frequently.
- Avoid putting hot or warm food straight into the fridge.
- Ensure to place refrigerator or freezer in a cool position, protected from direct sunlight. Also, avoid placing it too close to radiators, ovens or dishwashers.
- Replacing older model refrigerator, especially if older than 10 years. Older models can often use over three times the energy of newer models.
- Keep freezer full. An empty freezer will lose a lot of cold air every time you open it and new hot and moist air will replace it, resulting in more ice build-up and more energy loss.

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- Make sure refrigerator door seals are airtight. One can test them by closing the door over a piece of paper so that half is in and half is out of the refrigerator.

Washing Machine

- Use less water and use cooler water. Switching temperature setting from hot to warm can cut a load's energy use in half and unless you're dealing with oily stains, the warm or cold water setting will generally do a good job of cleaning your clothes.
- To get the maximum efficiency out of your clothes washer, wash only full loads. If you need to wash a small load, be sure to use the appropriate water-level setting.
- To get the maximum efficiency out of clothes dryer, dry towels and heavier cottons in a separate load, clean the lint filter after every load to improve air circulation and periodically check your dryer vent to ensure it is not blocked.
- Buy front loader. This uses 25 percent less energy than a standard model.
- During spring and summer months, dry clothes in the sun instead of using a clothes dryer.
- Use the correct amount of detergent. This avoids unnecessary machine work and energy consumption.

Lighting Products

- Paint the walls of home a light colour. Dark colours tend to absorb light, requiring more energy from light bulbs to achieve the same effect.
- Use linear fluorescent and energy-efficient compact fluorescent lamps (CFLs) in fixtures throughout the home to provide high-quality and high-efficiency lighting.
- Use electronic chokes in place of conventional copper chokes.

Contd...

- Use outdoor lights with a photocell unit or a timer so they will turn off during the day and turn off decorative outdoor gas lamps.
- Houses should be built in a way that they use the natural light during the day.
- Banning the use of incandescent bulbs, as done by various countries.
- Light bulbs lose their brightness and sheen because of dirt. A regular house maintenance and removal of dust can increase light output.

Television (for producers)

- Specify the maximum power levels while "on" and "off".
- Ensure that the consumer can easily switch the unit to the lower power level.
- Energy is consumed when on standby mode. A good way to do this is to inscribe it on a label and stick it to the appliance.

Computer

- If not in use, place it in sleep mode. This will completely turn certain aspects of the computer off, while maintaining a limited amount of power to it.
- Screen savers save computer screens, not energy. Shutting computer down and starting it again to use reduces system wear and saves energy.

Fans

- Ensuring purchase of energy-efficient products.
- Replace conventional regulators with electronic regulators for ceiling fans.
- Install exhaust fans at a higher elevation than ceiling fans.

Source: Compiled from various sources, including Best Practices in Energy Efficiency, Air Conditioners, 2010, http://www.bun-ca.org/publicaciones/fasciculos/english/Airconditioner.pdf

Chapter 5
Results and Findings from the Survey on Consumer Awareness on Energy Efficient Products

Introduction to Survey Aims, Objectives and Expected Outcomes

The primary objective of the survey is to study the present status of consumers' awareness and their perception on energy-efficient products in India. Since the focus of the study is to measure consumers' awareness, products which are now BEE's standards and labelling programme – under mandatory and voluntary lists – and some which are likely to be included in the lists have been included.

Another product, which is though not in the BEE's S&L programme, namely, CFL bulbs, has also been included. The study, thus, includes both high-priced products such as air conditioners as well as low priced products such as CFLs. Such products' coverage is expected to provide a basis for a strategy to promote energy efficiency and conservation by correctly characterising the present status of awareness.

The study also aims to shed light on understanding the need for energy efficiency and conservation; the use of energy efficient products; and the determinants of such use, including barriers to increase in usage of such products.

There are three components to the survey, as indicated in Chapter 1. Besides consumers (20,166), producers (51) and traders (551) are also included. The survey, thus, covers both demand and supply-side forces. To make the survey inclusive and representative of all India, states from all the four regions have been included. The survey has gone much deeper at the state level, as it has covered four districts in each of the states, covering four regions, in addition to the state capital. A detailed distribution of sample size for each of the states is given in Annexure 5.1.

Considering the coverage of the survey and also types of stakeholders – consumers (demand side) and traders and producers (supply side forces) – one can say that the findings will generate a holistic picture of market for energy-efficient products in India.

Perceptions and inputs from demand and supply-side forces are combined to achieve the following outcomes:

- A benchmark on consumer awareness on energy efficient products;
- Better understanding of consumers' perception on energy efficiency;
- An understanding of barriers to both awareness and usage;
- An understanding of supply-side factors determining usage patterns;
- Channels that can be more effective in popularising the concept of EE products;
- Consumers' willingness to pay for energy efficient appliances;
- Future demand projections; and

- Understanding international good practices on energy efficiency and how they can be replicated in India.

This Chapter is divided into four sections. Section I shows respondents' characteristics, including the coverage of the survey and how the sample size in all the three segments (consumers, producers and traders) is distributed.

Section II highlights issues relating to ownership and usage of electrical appliances, their trends and usage patterns. The information from consumer survey is being supplemented by information from producers' and traders' survey.

Section III focuses on energy efficiency of electrical appliances from consumers' perspective. It tries to assess consumer awareness of energy efficiency, whether energy efficiency is now being considered as an important issue in making purchase decisions.

It also covers consumers' perception about energy efficient products; ownership of energy-efficient products; channels of generating effective awareness; consumers' willingness to know more about energy efficiency; satisfaction derived from use of energy-efficient products, in terms of electricity bills, problems faced in shifting to energy-efficient products by consumers and others.

Section IV sums up the survey findings and contains the conclusion.

Respondents' Characteristics

Consumers

As indicated earlier, the survey covers three of the most important stakeholders – consumers, producers and traders – in the electrical home appliance sector in India. The survey intends to cover both rural and urban areas.[37] However, the survey may be biased in the sense that it includes rural areas in a radius of up to 10 km from the district town. The coverage of the survey is restricted in view of the general belief that only households with

Table 5.1: Respondents' Characteristics: Consumers

Type of Family	*Frequency*	*Percent*
Nuclear family	12491	61.9
Joint family	7675	38.1
Total	*20166*	*100.0*
Class of Family	*Frequency*	*Percent*
Above poverty line (APL)	16934	84.0
Below poverty line (BPL)	3232	16.0
Total	*20166*	*100.0*
Category	*Frequency*	*Percent*
Did not respond	1	0.0
Scheduled caste (SC)	2281	11.3
Scheduled tribe (ST)	1090	5.4
Other backward caste	5774	28.6
General	10671	52.9
Others	349	1.7
Total	*20166*	*100.0*
Income Level (INR per month)	*Frequency*	*Percent*
Did not Respond	2	0.0
Up to 10,000	10040	49.8
10,001-20,000	6413	31.8
20,001- 40,000	3081	15.3
40,001- 75,000	462	2.3
75,001 and above	168	0.8
Total	*20166*	*100.0*
Occupation	*Frequency*	*Percent*
Did not respond	12	0.1
Service	7341	36.4
Business	5696	28.2
Farming	4229	21.0
Others*	2888	14.3
Total	*20166*	*100.0*

** Others (occupations) include advocates, doctors, electricians, hawker, mechanic, etc.*

effective electricity connection can give the needed feedback on usage of electrical home appliances and, therefore, only areas with proper electrification have been covered.

In the consumers' segment, to ensure that the survey encompasses all types of users of electrical home appliances, different types and classes of consumers have been included. The distribution of consumers' survey has been made in terms of the type of family, class of family, category of family, income level and occupation. This classification is important as it will help in understanding the perceptions and issues of different types of consumers. It will also help in understanding what specific initiatives need to be undertaken to improve the situation.

In all the three types of samples, some dominant segments are observed. While consumers above the poverty line have a dominant share in the class of family, nuclear family has the highest share in case of the type of family. General castes, considered to be a major user segment of home appliances, constitute the largest segment in the case of family category. More details on how the consumer survey is distributed across the identified parameters are given in Table 5.1.

Traders

In the case of traders, care has been taken to include different types of traders involved in the sales of electrical home appliances. These include both small and big traders and cover dealers, distributors and proprietorship, multi-brand and executive outlets. Broadly, these firms can be categorised into two types: by type of ownership and type of store. Distribution of firms by these two criteria is given in Table 5.2. It is observed that both types of distribution are dominated by one major segment. While proprietorship is the most dominating segment in type of ownership, multi-brand outlets dominate distribution by type of store. This will help in

Table 5.2: Respondents' Characteristics: Traders		
Type of Ownership	*Frequency*	*Percent*
Dealer	4	0.7
Distributor	7	1.3
Franchisee	5	0.9
Partnership	33	6.0
Private Ltd	5	0.9
Proprietorship	470	85.3
Retailer	27	4.9
Total	*551*	*100*
Type of Store	*Frequency*	*Percent*
Multi-brand outlets	534	96.9
Executive outlets	17	3.1
Total	*551*	*100*

generating clear understanding of different types of traders with their views on how to improve the existing situation.

Producers

As in the case of traders, producers' survey has also covered different types of producers, big and small; limited liability and proprietorship firms; and domestic and MNC subsidiary firms. However, limited liability firms constitute the dominant

Table 5.3: Respondents' Characteristics: Producers		
Type of Ownership	*Frequency*	*Percent*
Ltd.	40	80.0
Sole proprietorship	10	20.0
Total	*50*	*100.0*
Type of Organisation	*Frequency*	*Percent*
Pvt. Ltd.	30	60.0
Ltd.	10	20.0
MNC sub	2	4.0
Others	8	16.0
Total	50	100.0

share in the total. Eighty percent of the firms (or 40 in number) selected for the survey are limited firms. A more detailed description of firms is given in Table 5.3.

Usage of Electrical Appliances, Their Ownership, Duration of Use and Usage Trend

Electrical appliances covered in the survey include lights (bulbs/CFLs); refrigerators; air conditioners; geysers; fans; televisions and LCDs; washing machines; microwave ovens; food processors; mixer-grinders; irons; dishwashers; water/ irrigation pumps; and others. Among the products under the BEE's S&L programme, while four of the products are currently in the mandatory labelling programme, eight are in the voluntary list. There are also some products which are likely to be included in the S&L programme in the coming period.

Usage of Electrical Appliances and Ownership

Almost all the respondents covered under the consumer survey are users of electrical home appliances of one type or another. This gives a clear indication that penetration of electrical home appliances has increased significantly among households with electricity connection. It is observed that, in three of the identified appliances, namely, bulbs/CFLs, fans and television, the penetration is over 90 percent and is as much as 99.6 percent in the case of bulbs/CFLs, closely followed by fans (96.8 percent) and television (90.6 percent).

There are four other appliances whose penetration is in the range of 40 to 60 percent. These include tube lights (59.3 percent), irons (56.6 percent), refrigerators (50.3 percent) and mixer-grinders (46.2 percent). Appliances which have significantly low penetration below 10 percent are dishwashers, food processors, microwave ovens, LCDs, geysers and air conditioners, in that order (Table 5.4).

Table 5.4: Ownership of Electrical Home Appliances		
Appliances	**Households Owning Electrical Home Appliances**	**Share in Total Sample Size of 20166 *(percent)***
Refrigerators	10152	50.3
Lights		
Bulbs/CFLs	20076	99.6
Tube lights	11956	59.3
Air conditioners	1307	6.5
Geysers	1264	6.3
Fans	19518	96.8
TVs	18264	90.6
LCDs	916	4.5
Washing machines	3511	17.4
Microwave ovens	687	3.4
Food processors	382	1.9
Mixer-grinders	9323	46.2
Irons	11406	56.6
Dishwashers	67	0.3
Water/irrigation pumps	3418	16.9
Others*	1435	7.1
**Others (products) include coolers, computers, music systems, charger lights, etc.*		

Emerging trend in ownership of appliances reveals some interesting facts. Ownership of electrical home appliances varies in the range of 0.3 percent (water/ irrigation pumps) to 99.6 percent (bulbs/CFLs). There are at least six products ownerships which are yet to exceed the 10-percent mark. These include air conditioners and geysers (over six percent), LCDs and micro-wave ovens (in the range of three-five percent) and food processors (about two percent).

Table 5.5: Income Level and Ownership of Electrical Appliances

Appliances		Household Income						
		Did not respond	Up to 10,000	10,001-20,000	20,001-40,000	40,001-75,000	75,001 and above	Total
Refrigerators	Frequency	0	3255	4034	2280	421	162	10152
	Ownership %	-	32.4	62.9	74.0	91.1	96.4	50.3
Lights								
Bulbs/CFLs	Frequency	2	9996	6389	3061	460	168	20076
	Ownership %	-	99.6	99.6	99.3	99.8	100	99.6
Tube lights	Frequency	1	5200	4097	2113	388	157	11956
	Ownership %	-	51.8	63.9	68.6	84.0	93.4	59.3
Air conditioners	Frequency	0	172	327	457	228	123	1307
	Ownership %	0	1.7	5.1	14.8	49.3	73.2	6.5
Geysers	Frequency	0	236	378	409	167	74	1264
	Ownership %	0	2.3	5.9	13.3	36.1	44.0	6.3
Fans	Frequency	2	9511	6328	3053	458	166	19518
	Ownership %	0	94.7	98.7	99.1	99.1	98.8	96.8
TVs	Frequency	1	8687	6068	2920	431	155	18262
	Ownership %	0	86.5	94.6	94.8	93.3	92.3	90.6
LCDs	Frequency	1	186	242	314	118	55	916
	Ownership %	0	1.8	3.8	10.2	25.5	32.7	4.5
Washing machines	Frequency	0	677	1250	1131	313	140	3511
	Ownership %	0	6.7	19.5	36.7	67.7	83.3	17.4
Microwave ovens	Frequency	0	116	151	216	111	93	687
	Ownership %	0	1.1	2.3	7.0	24.0	55.3	3.4
Food processors	Frequency	0	74	103	116	59	30	382
	Ownership %	0	0.7	1.6	3.8	12.8	17.8	1.9
Mixer–grinders	Frequency	0	3389	3301	2090	390	153	9323
	Ownership %	0	33.7	51.5	67.8	84.4	91.1	46.2
Irons	Frequency	0	4612	4071	2249	351	123	11406
	Ownership %	0	45.9	63.5	73.0	76.0	73.2	56.6
Water/irrig. pumps	Frequency	0	20	19	23	5	0	67
	Ownership %	0	0.2	0.2	34	1.0	0	0.3
Dishwashers	Frequency	0	1072	1292	865	157	32	3418
	Ownership %	0	10.7	20.1	25	34.0	19.0	16.9
Others*	Frequency	0	426	534	360	60	21	1401
	Ownership %	0	4.2	8.3	26	13.0	12.5	6.9

**Others (products) include coolers, computers, music systems, charger lights, etc.*

Table 5.6: Occupation and Ownership of Electrical Appliances

		Occupation					Total
		Did not Respond	Service	Business	Farming	Others*	
Refrigerators	Frequency	7	4477	3675	957	1036	10152
	Ownership %	0	61.0	64.5	22.6	35.9	50.3
Lights							
Bulbs/CFLs	Frequency	11	7305	5666	4221	2873	20076
	Ownership %	0	99.5	99.4	99.8	99.5	99.6
Tube lights	Frequency	10	5155	3837	1594	1360	11956
	Ownership %	0	70.2	67.4	37.7	47.1	59.3
Air conditioners	Frequency	1	530	636	31	109	1307
	Ownership %	0	7.2	11.2	0.7	3.8	6.5
Geysers	Frequency	0	547	584	36	97	1264
	Ownership %	0	7.5	10.3	0.8	3.3	6.3
Fans	Frequency	11	7212	5591	4040	2664	19518
	Ownership %	0	98.2	99.8	95.5	92.2	96.8
TVs	Frequency	9	6933	5381	3621	2318	18262
	Row Wise %	0	94.4	94.4	85.6	80.3	90.6
LCDs	Frequency	0	373	404	59	80	916
	Ownership %	0	5.1	7.1	1.4	2.8	4.5
Washing machines	Frequency	1	1584	1482	142	302	3511
	Ownership %	0	21.6	26.0	3.4	10.5	17.4
Microwave ovens	Frequency	2	278	327	16	64	687
	Ownership %	0	3.8	5.7	0.3	2.2	3.4
Food processors	Frequency	0	164	186	12	20	382
	Ownership %	0	2.2	3.3	0.2	0.7	1.9
Mixer–grinders	Frequency	4	4195	3241	1019	864	9323
	Ownership %	0	57.1	56.9	24.1	29.9	46.2
Irons	Frequency	6	4710	3657	1886	1147	11406
	Ownership %	0	64.2	64.2	44.6	39.7	55.6
Water/irrig. pumps	Frequency	4	1377	1166	455	416	3418
	Ownership %	0	18.8	20.5	10.8	14.3	16.9
Dishwashers	Frequency	0	30	31	3	3	67
	Ownership %	0	0.4	0.5	0.01	0.1	0.3
Others**	Frequency	0	574	521	104	202	1401
	Ownership %	0	7.8	9.1	2.5	7.0	6.9

** Others (occupations) include advocates, doctors, electricians, hawker, mechanic, etc.*
***Others (products) include coolers, computers, music systems, charger lights, etc.*

Though higher income appears to have higher influence on ownership of high-priced appliances, as ownership declines with decline in income levels, but data also show that relatively high-priced appliances have started penetrating the lower income group consumers, though it is still limited. For example, in the case of air conditioners, it is observed that out of the 10,040 households with income of up to ₹10,000 (surveyed under the present study) about two percent own air conditioners. This is much lower if one compares air conditioners' ownership among the higher income groups. Ownership is found to be as high as over 73 percent in highest income brackets (above ₹75,000).

The figure, however, appears more impressive when one considers ownership at the aggregate level. Out of 1,307 people who are owning air conditioners, about 13 percent are from the lower income group (monthly income up to ₹10,000).

There are also other high-priced segments in which low income groups have emerged as major users. These include televisions (48 percent), refrigerators (32 percent), LCDs (20 percent) and others (Table 5.5).

Observations from distribution of ownership of electrical appliances in terms of occupation appear to be consistent with the general understanding that people in services and business segments are major users of relatively high cost electrical home appliances. It is observed that in almost all the product segments people in services constitute the largest user class (Table 5.6).

Six segments in which business class people constitute the largest user segment are air conditioners and food processors (49 percent each); microwave ovens (48 percent); geysers and dishwashers (46 percent each); and LCDs (44 percent).

Duration of Use of Electrical Home Appliances

As far as the duration[38] of use of electrical appliances is concerned, a significant number of people have added/ upgraded electrical appliances in the last one-two year period. Bulbs/CFLs are heading the trend, followed by tube lights (Table 5.7). This could be, however, because of short use life cycle, requiring frequent replacements. The development in the case of LCDs, dishwashers, air conditioners and microwave ovens is more interesting – out of the total users of LCDs, 53 percent have added this product in the last one-two years; in dishwashers, 48 percent new users have been added; air conditioners and microwave oven segments have added 39 percent each new users during the same period.

Table 5.7: Duration of Use of Electrical Appliances *(in percent)*

Appliances	Year of Purchase				Total
	In last 1-2 years	In last 3-5 years	In last 6-8 years	Over 8 years	
Refrigerators	23	37	21	19	100
Lights					
Bulbs/CFLs	90	9	1	0	100
Tube lights	70	21	5	3	100
Air Conditioners	39	35	23	3	100
Geysers	21	38	24	17	100
Fans	19	38	21	22	100
TVs	18	36	27	19	100
LCDs	53	36	7	3	100
Washing machines	25	38	22	15	100
Microwave ovens	39	35	16	10	100
Food processors	27	40	18	14	100
Mixer-grinders	18	38	25	18	100
Irons	21	45	21	13	100
Dishwashers	48	24	19	9	100
Water/irrigation pumps	18	33	27	22	100
Others*	62	26	0	12	100

**Others include coolers, computers, music systems, charger lights, etc.*

There are at least three other products which have achieved significant gains (in the range of 20 to 30 percent) in terms of increased market penetration in the last one-two years. These include food processors (27 percent); washing machines (25 percent); and geysers (21 percent).[39]

Trend in Electricity Consumption by Households

Consumer response on electricity consumption has been received in two formats: average consumption in units and INR for summer and winter seasons. Responses clearly indicate that average electricity consumption[40] is more in summer than in winter. While in the case of units, average electricity consumption works out 156 units for summer, it is relatively low for winter season at 114 units. A similar pattern is observed in the case of average consumption in INR. Average consumption in summer is more than that of winter by more than 25 percent in both units and INR (Table 5.8).

Table 5.8: Trend in Monthly Electricity Consumption

(answered only in units)	
	Average (units)
Summer	155.58
Winter	114.12
Average per-household consumption	**134.8**
(answered only in INR)	
	Average (INR)
Summer	475.71
Winter	346.40
Average per-household consumption	**411.05**

Different patterns of electricity consumption are observed across type of family; income levels; and also different occupations. In the case of type of family, average electricity consumption is found to be on a higher side in summer in both units and INR terms.

Table 5.9: Type of Family and Average Monthly Electricity Consumption

(answered in units)				
		Nuclear	Joint	Average per-household Consumption
Summer	Frequency %	161 58	146 58	153 58
Winter	Frequency %	118 42	106 42	112 42
Average per-household consumption	Frequency	139.5	126.0	132.5
(answered in INR)				
		Nuclear	Joint	Average per-household Consumption
Summer	Frequency %	480 58	468 58	474 58
Winter	Frequency %	351 42	339 42	345 42
Average per-household consumption	Frequency	415.5	403.5	409.5

Nuclear families appear to be using more electricity than joint family households in summer as well as in winter seasons (Table 5.9). This could probably be because of higher per capita income enjoyed by nuclear family (refer to Table 5.10). It could also be indicative of the fact that a majority of nuclear family households are living in state capitals or other bigger cities.

People in higher income bracket use more electricity than those in the lower income brackets. Data reflect that average electricity consumption declines with decline in income levels. This is consistent with the general understanding that people with higher income consume more electricity than those in the lower income groups. This is true for both summer and winter seasons and in units and INR (Table 5.10).

Table 5.10: Income Level and Average Electricity Consumption

(answered in units)							
		Up to 10,000	10,001-20,000	20,001-40,000	40,001-75,000	75,001 and above	Average per-household Consumption
Summer	Frequency %	115 57	168 57	213 59	286 60	310 59	218 59
Winter	Frequency %	87 43	125 43	150 41	189 40	219 41	154 41
Average per-household consumption	Frequency %	101 100	146.5 100	181.5 100	238 100	264.5 100	186.2 100
(answered in INR)							
		Up to 10,000	10,001-20,000	20,001-40,000	40,001-75,000	75,001 and above	Average per-household Consumption
Summer	Frequency %	315 57	532 58	733 58	1131 61	1373 58	817 59
Winter	Frequency %	238 43	388 42	520 42	736 39	976 42	571.6 41
Average per-household consumption	Frequency	553	920	1254	1867	2349	277.7

There is, however, significant variation in consumption of electricity in summer and winter. A difference of more than 25 percent is observed between summer and winter consumption across almost all the income segments.

Those who are in business consume relatively higher units than people in other occupations. This is observed both in units consumed as well as in INR. They are closely followed by service class people, who are the second-largest consumer in both summer and winter seasons.

It is observed that farming class is at the bottom of the pyramid and they constitute almost half of the consumption of business class and also, significantly, lower than the service

Table 5.11: Occupation and Average Monthly Electricity Consumption

(answered in units)						
		Service	Business	Farming	Others*	Average per-household Consumption
Summer	Frequency %	162 57	183 58	97 57	134 77	144 58
Winter	Frequency %	121 43	133 42	72 43	95 23	105.2 42
Average per-household consumption	Frequency	142	158.5	84.5	115	124.6
(answered in INR)						
		Service	Business	Farming	Others*	Average per-household Consumption
Summer	Frequency %	532.87 58	601.13 58	247.42 56	414.80 58	449 58
Winter	Frequency %	387.04 42	431.50 42	193.23 44	298.30 42	327 42
Average per-household consumption	Frequency	460.5	516	220.5	357	388.5

class people (Table 5.11). This might be because of relatively low income and unavailability of power.

Whether Overburdened by Electricity Bill?

A large number of respondents (almost 47 percent) feel that they are overburdened by electricity bills (Table 5.12). This might be because of low income level or also based on their understanding that they pay more than other users. Another important reason for this could be that, since a large number of consumers in urban areas do not own houses, they do not have meters in their names and live on rent.

This set of consumers usually pays a usage rate which is 25 to 50 percent higher than what is charged by the utilities. The

same was discovered during interactions with consumers during the field survey. Things can improve for them if these consumers get meter/sub-meter in their names and are charged accordingly.

On the other hand, more than half of the respondents opined that they are not overburdened by electricity bills. "We get our bills as per our usage and there is no surprise element in this", a large number of respondents opined. This positive view may be because of increasing per capita income and greater awareness about per unit electricity consumption by home appliances.

Table 5.12: Consumer Perception on Being Overburdened with the Electricity Bills?

	Frequency	Percent
Did not respond	54	0.3
Yes	9443	46.8
No	10669	52.9
Total	20166	100.0

An overwhelming nine out of ten respondents said that they take care to ensure to switch off electronic appliances not in use (Table 5.13). This definitely sounds to be a very important development and can significantly contribute in improving energy efficiency situation at the national level. This may be because of a combination of various positive and negative

Table 5.13: Do You and Your Family Members Switch Off Electronic Appliances When Not in Use?

	Frequency	Percent
Did not respond	57	0.3
Yes	19203	95.2
No	906	4.5
Total	20166	100.0

factors such as increasing awareness about efficient use of power, environmental concerns, increasing electricity bills and others.

There does not appear to be any definite relationship between the income level and the habit of switching off electronic appliances, as indicated in the Table 5.14A. The responses in all the income categories are almost similar. In all the income segments, more than 95 percent people switch off electronic appliances when not in use.

Table 5.14: Income Level and the Habit of Switching Off Electronic Appliances When Not in Use

		HH Income level					
		Up to 10,000	10,001-20,000	20,001-40,000	40,001-75,000	75,001 and above	Total
Did not respond	Frequency	26	14	15	2	0	57
	%	0.3	0.2	0.5	0.4	0.0	0.3
Yes	Frequency	9497	6163	2936	441	165	19203
	%	94.6	96.1	95.3	95.5	98.2	95.2
No	Frequency	517	236	130	19	3	906
	%	5.1	3.7	4.2	4.1	1.8	4.5
Total	Frequency	10040	6413	3081	462	168	20166

Table 5.14A: Summary of Table 14: Switching Off Electronic Appliances When Not in Use

Income Levels	*Switch Off (% of total)*	*Do Not Switch Off (% of total in each income level)*
Up to Rs. 10,000	95	5
Rs. 10,001-20,000	96	4
Rs. 20,001-40,000	95	5
Rs. 40,001-75,000	95	5
Over Rs. 75,001	98	2

However, people in the highest income bracket have slight edge over people in the lowest income bracket. Only about two percent people in this category answered in the negative, compared to over five percent in case of the lowest income bracket (up to ₹10,000).

Not much difference is found across different occupations and people's habit of switching off electronic appliances when not in use. Respondents appear to be concerned with efficient and economical use of electricity across all occupations. This is duly reflected by Tables given below (Table 5.15 and 5.15A). The percentages of people who switch off electronic appliances are in the range of 94 to 98 percent in different occupations.

Table 5.15: Occupation and the Habit of Switching Off Electronic Appliances When Not in Use

		Occupation				Total
		Service	Business	Farming	Others*	
Did not respond	Frequency %	24 0.3	22 .4	4 .1	6 .2	57 .3
Yes	Frequency %	6915 94.2	5405 94.9	4048 95.7	2824 97.8	19203 95.2
No	Frequency %	402 5.5	269 4.7	177 4.2	58 2.0	906 4.5
Total	Frequency	7341	5696	4229	2888	20166

** Others (occupations) include advocates, doctors, electricians, hawkers, mechanics, etc.*

Table 5.15A: Summary of Table 15: Switching Off Electronic Appliances When Not in Use

Occupation	*Switch Off (% of total)*	*Do Not Switch Off (% of total in each occupation)*
Services	94	5
Businesses	95	4
Farming	96	5
Others*	98	5

** Others (occupations) include advocates, doctors, electricians, hawkers, mechanics, etc.*

However, within the three most dominant occupations, respondents engaged in farming activities show more promise.

Factors Considered by Consumers for Purchase of Electrical Appliances

Consumers were assessed for factors which they consider important while making purchase decisions for electrical appliances. The assessment was made for each of the product categories, but restricted to product ownership.

Product brand is considered to be the most important factor determining the purchase decisions (except in the case of LCDs). This is observed across all product segments (Table 5.16). However, there is wide ranging variation in different product segments. There are at least seven product segments in which more than 40 percent consumers give top priority to brands. These include irons (47 percent); water/ irrigation pumps, tube lights and fans (46 percent each); mixer-grinders (45 percent); dishwashers (43 percent); and televisions (40 percent). This preference for brand is also true for the remaining product segments, more than 30 percent consumers give priority to brands.

Product price appears to be the second-most important factor that determines purchase decisions for electrical appliances, with one visible exception of LCDs. Consumers in the range of 20 to 40 percent across different product segments consider price an important factor while making purchase decisions.

Consumers' preference for energy-efficient products till now appears to be a lowly placed determinant factor in all the product segments. Whatever competition it has with other factors is seen with marketing/ promotional offers. There are only three product segments in which more than 10 percent consumers consider energy efficiency as an important determining factor. These include bulbs/CFLs (19 percent); air conditioners (17 percent); and refrigerators (11 percent).

Table 5.16: Factors Considered/Would Be Considered for Purchase of Electrical Appliances *(percent)*

Appliances	Factors Considered					Total
	Brand	Model	Price	Marketing/ Promotional offers	Energy Efficiency	
Refrigerators	38	20	23	7	11	100
Lights						
Bulbs/CFLs	38	11	28	3	19	100
Tube lights	46	11	30	4	8	100
Air conditioners	30	19	22	12	17	100
Geysers	38	15	30	9	9	100
Fans	46	15	31	5	3	100
TVs	40	23	26	7	3	100
LCDs	30	33	17	14	7	100
Washing machines	36	17	28	12	6	100
Microwave ovens	33	22	26	13	6	100
Food processors	33	20	29	13	5	100
Mixer-grinders	45	15	30	7	3	100
Iron	47	12	34	3	3	100
Water/irrig. pumps	46	13	31	7	3	100
Dishwashers	43	14	30	8	5	100
Others*	44	14	36	2	4	100

**Others include coolers, computers, music systems, charger lights, etc.*

Linking consumers' preference for energy efficiency with ownership leads to a more revealing picture. There are two products in which a majority of consumers give/would give more preference to energy efficiency while making purchase decisions (Table 5.17). These include water/irrigation pumps (53.7 percent) and air conditioners (51.2 percent).

Incidentally, these two products are major users of electricity amongst all the home appliances. In three other products – namely, bulbs/CFLs, LCDs and refrigerators – more than one-third of consumers consider/would consider energy efficiency while making purchase decisions. In other product

Table 5.17: Distribution of Consumers Who Considered/ Would Consider EE while Making Purchase Decisions

Appliances	Ownership	Consumers Who Consider EE	Percent
Refrigerators	10152	2794	27.5
Lights			
Bulbs/CFLs	20076	7241	36.1
Tube lights	11956	1781	14.9
Air conditioners	1307	670	51.2
Geysers	1264	204	16.1
Fans	19518	875	4.5
TVs	18264	1146	6.3
LCDs	916	326	35.6
Washing machines	3511	542	15.4
Microwave ovens	687	118	17.2
Food processors	382	60	15.7
Mixer–grinders	9323	605	6.5
Irons	11406	515	4.5
Water/irrig. pumps	67	36	53.7
Dishwashers	3418	191	5.6
Others*	1435	93	12.4

**Others include Cooler, computer, music system, charger light, etc.*

segments, preference for energy efficiency is found to be quite low. In some cases, it is as low as below the 10-percent mark.

What Consumers Understand by Energy Efficiency?

This question was restricted to those who consider energy efficiency as an important factor while making purchase decisions and is based on responses for energy efficiency as received in Table 16. The data reveals that about 41 percent of consumers consider energy efficiency for making purchases, but for different reasons (Table 5.18).

Table 5.18: What Consumers Mean by Energy Efficiency		
	Frequency	**Percent**
Did not respond	11948	59.2
Very low energy used	1034	5.1
Appliances consuming low power	57	0.3
Consumption of less electricity	86	0.4
Electricity bill is less	1762	8.7
Electricity saved	499	2.5
Good product use	16	0.1
Less consumption of electricity	1257	6.2
Save power	3507	17.4
Very low energy used	1	0.0
Total	**20166**	**100.0**

Most of the responses on what consumers mean by energy efficiency implies are concentrated on low power consumption, leading to lower electricity bills. Consumers do not appear to be aware of and are not much concerned with environmental impact of energy production and use. One can expect this situation to continue even in the near future, considering lack of awareness on such issues.

There are various sources through which consumers identify energy efficient home appliances. The most significant of all sources of information is "Star Marks" – or say BEE's label – on the products.

It is interesting to note that nearly eighty percent of consumers (who consider energy efficiency as a determining factor in purchase decisions) identify energy-efficient products by seeing star marks. This is indicative of the rising popularity of BEE's star-labelled products and also consumers' increasing awareness about BEE's labelled products. Television followed by shopkeepers (traders) is another important source which helps consumers identify energy-efficient products.

Table 5.19: How Consumers Identify Energy-efficient Appliances?		
	Frequency	**Percent**
Brand	120	1
Expert advice	54	1
Friends & relatives	193	2
ISI mark	29	0
Newspaper	36	0
Different packing	3	0
Radio	10	0
Saving of electricity	310	4
Shopkeepers	299	4
Star mark	6444	79
Television	438	5
Don't know	244	3
Total	**8180**	**100**

Energy Efficiency of Electrical Appliances from Consumer Perspective

Consumers' Awareness of Energy Efficient Products

Data demonstrates that over 43 percent consumers agree that they consider/would consider energy efficiency of products as a purchase-determining criterion, leaving about 57 percent consumers who do not consider this while making purchases (Table 5.20).

This, however, does not imply that awareness about energy-efficient products is limited to these consumers only. Among those who do/would not consider energy efficiency as a purchase criterion, about 22 percent consumers revealed that they are aware of such products, but are not using these due to various reasons. These two segments combined together

Table 5.20: Consumer Awareness of Energy-efficient Products		
	Frequency	**Percent**
Consumers who consider/would consider energy efficiency for purchase of an appliance	8746	43.4
Do not consider energy efficiency but are aware	4384	21.7
Not aware	7036	34.9
Total	20166	100.0

take the total number of people aware of energy-efficient or BEE labelled products to over 65 percent.[41]

While Table 5.21 gives a description of how awareness is distributed across family types, Table 5.21A reflects the trend in awareness level in the two types of families. It is observed that people in joint family system have higher level of awareness than those in the nuclear family system. Their level of awareness is found to be about 15 percentage points higher than the other type of family.

Table 5.21: Family Type and Awareness of Energy-efficient Products				
		Family Type		Total
		Nuclear	Joint	
Consumers who consider/would consider energy efficiency for purchase of an appliance	Frequency %	4728 37.9	4018 52.4	8746 43.4
Do not consider energy efficiency but are aware	Frequency %	2764 22.1	1620 21.1	4384 21.7
Not aware	Frequency %	4999 40.0	2037 26.5	7036 34.9
Total	Frequency	12491	7675	20166

Table 5.21A: Consumers Who Either Consider Or Are aware of Energy-efficient Products		
	Nuclear Family (percent of total)	*Joint Family (percent of total)*
Consumers who consider/would consider energy efficiency for purchase of an appliance	37.9	52.4
Do not consider energy efficiency but are aware	22.1	21.1
Total (aware)	60.0	73.5

Awareness level appears to be directly influenced by income level. There is a clear and definitive relationship between these two. Consumers with higher income have higher level of awareness than those with low income levels (Table 5.22 and 5.22A). The gap in the awareness level between the lower income (below ₹10,000) and the highest income groups (over ₹75,000) is more than 25 percentage points. The gap in awareness declines with every increase in the level of income.

Table 5.22: Income Level and Awareness of Energy-efficient Products								
Appliances		Income and Awareness Level						
		Did not respond	Up to 10,000	10,001-20,000	20,001-40,000	40,001-75,000	75,001 and above	Total
Consumers who consider/ would consider energy efficiency for purchase of an appliance	Frequency %	2 0.0	3216 32.0	3145 49.0	1935 62.8	321 69.5	127 75.6	8746 43.4
Do not consider energy efficiency but are aware	Frequency %	0 0.0	2459 24.5	1342 20.9	525 17.0	48 10.4	10 6.0	4384 21.7
Not aware	Frequency %	0 0.0	4365 43.5	1926 30.0	621 20.2	93 20.1	31 18.5	7036 34.9
Total	Frequency	2	10040	6413	3081	462	168	20166

Table 5.22A: Consumers Who Either Consider/Would Consider Or Are Aware of Energy-efficient Products

	Income Levels (Rs.)				
	Up to 10,000	10,001-20,000	20,001-40,000	40,001-75,000	75,001 and above
Consumers who consider/ would consider energy efficiency for purchase of an appliance	32.0	49.0	62.8	69.5	75.6
Do not consider energy efficiency but are aware	24.5	20.9	17.0	10.4	6.0
Total aware	**56.5**	**69.9**	**79.8**	**79.9**	**81.6**

Almost a similar pattern of awareness of energy-efficient products is observed across different occupations. Business people and people in other occupations appear to have a slight edge over other categories of people. What is interesting is that people even in farming have significant level of awareness of energy-efficient products.

Table 5.23: Occupation and Awareness of Energy-efficient Products

		Occupation					Total
		Did not Respond	Service	Business	Farming	Others*	
Consumers who consider/ would consider energy efficiency for purchase of an appliance	Frequency %	7 -	3196 43.5	2775 48.7	1360 32.2	1408 48.8	8746 43.4
Do not consider energy efficiency but are aware	Frequency %	4 -	1535 20.9	1181 20.7	1057 25.0	607 21.0	4384 21.7
Not aware	Frequency %	1 -	2610 35.6	1740 30.5	1812 42.8	873 30.2	7036 34.9
Total	Frequency	12	7341	5696	4229	2888	20166

** As indicated in earlier Tables (occupations).*

Table 5.23A: Consumers Who Either Consider Or Are Aware of Energy-efficient Products

	Occupation			
	Service	*Business*	*Farming*	*Others**
Consumers who consider/ would consider energy efficiency for purchase of an appliance	43.5	48.7	32.2	48.8
Do not consider energy efficiency but are aware	20.9	20.7	25.0	21.0
Total aware	64.4	69.4	57.2	69.8

** As indicated in earlier Tables (occupations).*

Besides those who either agree to use energy efficiency as a criterion or are aware of energy-efficient products, there are a significant number of people who showed their willingness to learn more about energy-efficient products. More than 29 percent respondents expressed their willingness to learn more about energy-efficient products (Table 5.24). This makes the development really significant and can be helpful in achieving market transformation for home appliance products, if supported by introduction of necessary measures by the BEE.

Table 5.24: Consumers' Interest in Learning More about Energy Efficiency and Conservation

	Frequency	*Percent*
Consumers who are aware about energy efficient products	13130	65.1
Yes	5880	29.2
No	1156	5.7
Total	20166	100.0

A mix of responses is observed when one relates family type and interests for learning more about energy efficiency. While a relatively higher percentage of people in joint family (73.5 percent) indicated that they (would) consider/use energy efficient products, compared to nuclear family (60 percent), a

larger number of people in nuclear family (34 percent) showed their interest in knowing more about energy-efficient products, compared to joint family (29 percent) (Table 5.25).

Table 5.25: Family Type and Interest in Learning More about Energy Efficiency and Conservation

		Type of Family		Total
		Nuclear	Joint	
Consumers who are aware about energy efficient products	Frequency %	7492 60.0	5638 73.5	13130 65.1
Yes	Frequency %	4188 33.5	1692 22.0	5880 29.2
No	Frequency %	811 6.5	345 4.5	1156 5.7
Total	Frequency	12491	7675	20166

A clear trend is observed when one relates income level with use and interest in knowing more about energy efficiency. Analysis reveals that, while a larger percentage of consumers in high income group indicated their awareness of energy-efficient products, consumers in lower income groups show higher willingness to learn about energy-efficient products

Table 5.26: Income Level and Interest in Learning More about Energy Efficiency and Conservation

Appliances		Income Level						
		Did not respond	Up to 10,000	10,001-20,000	20,001-40,000	40,001-75,000	75,001 and above	Total
Consumers who are aware about energy efficient products	Frequency %	2 -	5675 56.5	4487 70.0	2460 79.8	369 79.9	137 81.5	13130 65.1
Yes	Frequency %	0 -	3631 36.2	1579 24.6	557 18.1	88 19.0	25 14.9	5880 29.2
No	Frequency %	0 -	734 7.3	347 5.4	64 2.1	5 1.1	6 3.6	1156 5.7
Total	Frequency	2	10040	6413	3081	462	168	20166

(Table 5.26). It is, however, observed that a relatively bigger percentage of consumers (over seven percent) in the lowest income group (up to ₹10,000) show their reluctance to know more about energy efficiency. This is relatively higher than those in other income groups.

Business class people constitute the largest group who have greater interest in learning more about energy-efficient products. A larger percentage of people in this class is aware of energy-efficient products, compared to people in other occupations (Table 5.27). However, it is also observed that people in the services class show greater willingness to know more about energy-efficient products. In the case of farming community, it is observed that over 33 percent show their willingness to know more.

Table 5.27: Occupation and Interest in Learning More about Energy Efficiency and Conservation

		Occupation					Total
		Did not Respond	Service	Business	Farming	Others	
Consumers who are aware about energy efficient products	Frequency	11	4731	3956	2417	2015	13130
	%	-	64.4	69.5	57.2	69.8	65.1
Yes	Frequency	1	2264	1485	1412	718	5880
	%	-	30.8	26.1	33.4	24.9	29.2
No	Frequency	0	346	255	400	155	1156
	%	-	4.7	4.5	9.5	5.4	5.7
Total	Frequency	12	7341	5696	4229	2888	20166

Consumer Interest to Know More Needs to Be Augmented through Supply-side Forces

Despite interest shown by consumers to know more about energy-efficient products, some supply-side constraints in the market place are observed, which might hamper the on-going drive on energy efficiency. Overall, the situation can be further improved by addressing such issues.

A significant percentage of traders (over 44 percent) feel that there is a need to train those who directly, or indirectly, interact with consumers in sales of electrical/electronic home appliances (Table 5.28). For more details on how traders feel the need for formal training, see Annexures 5.2 and 5.3. Out of a total of 551 traders who were surveyed, less than 30 percent have received formal training for promotion and sales of home appliances (Table 5.29). For further details, refer to Annexures 5.4 and 5.5.

Industry associations appear to be the most important source of formal training, as indicated by traders. About 45 percent of traders have received training from such associations to promote sales of energy-efficient appliances. BEE, with a share of 13 percent, is the second-largest provider of formal training (Table 5.30). Major sources of training, as revealed by traders are described in Annexures 5.6 and 5.7.

Interaction with traders revealed that now they are in a better position to explain the differences between energy-efficient and non-energy-efficient products. Formal training received by traders appears to have made a huge difference in their (traders/sale executives) understanding of energy efficiency.

About 80 percent of traders indicated that the formal training received by them has helped them and they can now effectively explain the difference between energy-efficient and non-efficient-products to consumers (Table 5.31). The perception of different types of traders based on their capacity to effectively explain energy-efficient products is shown in Annexures 5.8 and 5.9.

Table 5.28: Need for Training Traders to Understand and Promote Energy-efficient Products

	Frequency	*Percent*
Yes	308	55.9
No	243	44.1
Total	551	100.0

Table 5.29 Traders' Experience about Formal Training for Promoting Energy-Efficient Products		
	Frequency	*Percent*
Yes	162	29.4
No	389	70.6
Total	551	100.0

Table 5.30: Who Provided the Formal Training?		
	Frequency	*Percent*
Industrial Association	78	45.0
NGOs	18	10.0
Bureau of Energy Efficiency (BEE)	22	13.0
Others	57	33.0
Total	175	100.0

Table 5.31: Whether Traders Can Explain the Differences between Efficient and Inefficient Energy Products		
	Frequency	*Percent*
Yes	441	80.0
No	110	20.0
Total	551	100.0

Major Sources of Information on EE Products to Consumers

Among the sources of information on energy-efficient products, television appears to be the most important source for 38 percent of consumers. It is followed by word of mouth (for over one-third consumers) and newspaper (Table 5.32). Despite the recent increased access of radio through FMs, it lags behind, compared to other sources of information.

Relating sources of information with income levels reveals a similar pattern as in the above Table. Television and word of mouth are the biggest sources of information to a majority

Table 5.32: Sources of Information on Energy-efficient Products		
Source	*Frequency*	*Percent*
Television	7175	38.0
Radio	1070	6.0
Newspapers	4061	21.0
Word of Mouth	5861	31.0
Others	822	4.0
Total	18989	100.0

of consumers in all the income segments (Table 5.33). What is, however, worth mentioning is that, with every increase in income level, there is increase in the percentage of consumers who rely on television for such information. This is in contrast to word of mouth, in which case, it is observed that, with every increase in income level, the percentage of consumers who rely on this source declines. Radio also follows a similar pattern. It appears to have an inverse relationship with income levels.

Table 5.33: Income Level and Sources of Information

		Income Level and Sources of Information						
		Did not respond	Up to 10,000	10,001-20,000	20,001-40,000	40,001-75,000	75,001 and above	Total
Television	Frequency	-	2707	2734	1464	201	69	7175
	%	-	35	39	40	40	45	38
Radio	Frequency	-	425	403	217	22	3	1070
	%	-	6	6	6	4	2	6
Newspapers	Frequency	-	1544	1560	805	118	32	4061
	%	-	20	22	22	24	21	21
Word of Mouth	Frequency	-	2627	2009	1032	149	44	5861
	%	-	34	29	28	30	29	31
Others	Frequency	-	406	245	155	12	4	822
	%	0	5	4	4	2	3	4
Total	**Frequency**	**2**	**7709**	**6951**	**3673**	**502**	**152**	**18989**

Two different patterns are observed when one relates sources of information with occupations. For those who are in service and business, television is the most important source (about 40 percent consumers expressed this), while for farming and other categories of consumers, word of mouth looks to be a more important source for about 38 percent people in each of the two categories (Table 5.34).

Table 5.34: Occupation and Sources of Information on Energy-efficient Products

		Occupation					Total
		Did not Respond	Service	Business	Farming	Others	
Television	Frequency	3	2746	2313	1127	986	7175
	%	-	40	39	33	34	38
Radio	Frequency	1	364	388	186	131	1070
	%	-	5	7	5	4	6
Newspapers	Frequency	1	1519	1360	615	566	4061
	%	-	22	23	18	19	21
Word of Mouth	Frequency	4	1854	1619	1299	1085	5861
	%	-	27	27	38	37	31
Others	Frequency	5	298	214	158	147	822
	%	-	4	4	5	5	4
Total	**Frequency**	**14**	**6781**	**5894**	**3385**	**2915**	**18989**

Trend in Ownership of Energy-efficient Products

In contrast to 43 percent consumers who indicated that they consider/would consider energy efficiency as a criterion for making purchase decisions and another 21 percent who are aware of energy efficiency, nearly 55 percent consumers own one or more types of energy-efficient appliances. This high percentage could be due to inclusion of CFLs in the list of products covered.

Table 5.35: Ownership of Energy-efficient Appliances		
	Frequency	*Percent*
Did not respond	1	0.0
Yes	10988	54.5
No	9177	45.5
Total	**20166**	**100.0**

Ownership of energy efficient appliances is more prevalent in the joint family system, as indicated by Table 5.36. Over 63 percent households in joint families own energy-efficient products. This is much higher in comparison to nuclear family households (49 percent). This may be because of greater level of awareness about energy efficiency in the joint family set up (as indicated earlier by Table 5.25).

Table 5.36: Type of Family and Ownership of Energy-efficient Appliances				
		Type of Family		Total
		Nuclear	Joint	
Did not respond	Frequency	0	1	1
	Column-wise %	0.0	0.0	0.0
Yes	Frequency	6130	4858	10988
	Column-wise %	49.1	63.3	54.5
No	Frequency	6361	2816	9177
	Column-wise %	50.9	36.7	45.5
Total	**Frequency**	**12491**	**7675**	**20166**

Ownership of energy-efficient appliances appears to be positively related with income levels, implying the higher the income, the higher the percentage of people who own energy-efficient appliances. This is clearly demonstrated by Table 5.37 below. Nearly four-fifths of consumers with incomes of above ₹75,000 own such appliances. This is in sharp contrast to only 43 percent people in the income group of up to ₹10,000

Table 5.37: Income Level and Ownership of Energy-efficient Appliances

		Income Level and Sources of Information						Total
		Did not respond	Up to 10,000	10,001-20,000	20,001-40,000	40,001-75,000	75,001 and above	
Did not respond	Frequency	0	0	1	0	0	0	1
	%	-	0.0	0.0	0.0	0.0	0.0	0.0
Yes	Frequency	2	4357	3858	2287	353	131	10988
	%	-	43.4	60.2	74.2	76.4	78.0	54.5
No	Frequency	0	5683	2554	794	109	37	9177
	%	-	56.6	39.8	25.8	23.6	22.0	45.5
Total	**Frequency**	**2**	**10040**	**6413**	**3081**	**462**	**168**	**20166**

owning energy-efficient appliances. It is also observed that, as the income level progresses, so does the ownership of EE appliances.

A larger percentage of business and service class consumers own energy-efficient products (Table 5.38). Ownership appears to be the lowest in the case of those who are engaged in farming activities. A little over 43 percent people in the farming category own energy-efficient appliances. Even this ownership might be concentrated in a very few products, for example CFLs and or irrigation pumps. The data, however, does not shed any light on this and, therefore, this needs further probe.

Table 5.38: Occupation and Ownership of Energy-efficient Appliances

		Occupation					Total
		Did not Respond	Service	Business	Farming	Others	
Did not respond	Frequency	12	0	0	1	0	1
	%	-	.0	.0	.0	.0	.0
Yes	Frequency		4052	3472	1826	1629	10988
	%	-	55.2	61.0	43.2	56.4	54.5
No	Frequency		3289	2224	2402	1259	9177
	%	-	44.8	39.0	56.8	43.6	45.5
Total	**Frequency**	**12**	**7341**	**5696**	**4229**	**2888**	**20166**

Traders' Perception of the Demand for Energy-efficient Products

An overwhelming number of traders (more than 94 percent) surveyed are of the opinion that the demand for energy-efficient products has increased significantly over the last couple of years (Table 5.39). The rate of increase in the demand, however, varies for different types of traders.

While the highest percentage of traders (over 28 percent) feel that the demand for energy-efficient products increased in the range of 10 to 20 percent in the last two years, another 27 percent feel it has increased by less than 10 percent. More importantly, about two-fifths of traders said the demand has risen by over 20 percent (Table 5.40).

Table 5.39: Traders' Perception of Increased Demand for EE Products over the Last Two Years

	Frequency	*Percent*
Yes	520	94.4
No	31	5.6
Total	551	100.0

Table 5.40: Traders Perception of the Rate of Increase in Demand for EE Products

	Frequency	*Percent*
Respondents who said that the demand for Energy Efficient Products has not increased	31	5.6
0-10%	151	27.4
10-20%	157	28.5
20-30%	101	18.3
Over 30%	111	20.1
Total	551	100.0

Table 5.41: Reasons for Increased Demand for EE Products (MA)		
	Frequency	*Percent*
Increased Income	68	11
Environmental Consciousness	79	12
Reduction in Electricity Bill	403	64
Sense of Responsibility	34	5
Media	50	8
Others	0	0
Total	634	100

Various reasons are cited by traders for this increased demand for energy-efficient products. Nearly two-thirds of traders are of the opinion that this increased demand is due to increased scope for reduction in electricity bill from the use of these products. Increased environmental consciousness and increased income are said to be other two important reasons for this increased demand (Table 5.41).

The demand for energy-efficient products is influenced by seasonal factors, as observed in varying sales of electrical appliances in different seasons. In response to the question "Do you observe seasonal variations in sales of electrical appliances", a large number (479 out or 551 or about 87

Table 5.42: Traders' Perception of Seasonal Variations in Sales				
		Store Type		Total
		Multi-brand Outlets	Executive Outlets	
Yes	Frequency %	463 86.7	16 94.1	479 86.9
No	Frequency %	71 13.3	1 5.9	72 13.1
Total	**Frequency**	**534**	**17**	**551**

percent) of traders indicated that there is a definitive seasonal variation in sales of electrical appliances (Table 5.42). This is true for both multi-brand and executive outlets. However, a bigger percentage of traders associated with executive outlets expressed this view (for a product-wise variation in sales, see Annexees 5.10, 5.11 and 5.12).

Trend in Duration of Use and Satisfaction Derived

Out of 55 percent people who are using energy-efficient products, about one-third consumers are using these for over a year now (Table 5.43). This implies that about 22 percent of energy-efficient products have been added in the last one year. This is a significant achievement, considering that standards and labelling programme is not very old in India, as indicated in Chapter 3.

Table 5.43: Duration of Use of EE Products

	Frequency	*Percent*
Do not possess energy efficient products in the household	9177	45.5
Less than 3 months	946	4.7
3-6 months	1587	7.9
6-12 months	1891	9.4
Over 12 months	6565	32.6
Total	20166	100.0

Among the users of energy-efficient products, about 41 percent consumers indicated either extremely high or high level of satisfaction. Among all the satisfaction categories, the largest number of users (37 percent) indicated medium level of satisfaction. A significant number of users, however, also indicated they are either not satisfied or lowly satisfied with the use of energy-efficient products (Table 5.44). This low

Table 5.44: Distribution of Consumers by Satisfaction Levels		
	Frequency	*Percent*
Extremely high	1586	14.4
High	2927	26.6
Medium	4055	36.9
Low	1081	9.8
No change	1340	12.3
Consumers owning energy-efficient products	10989	100.0

level of satisfaction might be due to negligible, or no, decline in electricity bills, lack of operational (technical) knowledge, increased duration of product use or rebound effect[42] and others.

One important reason for the low level of satisfaction with use of energy-efficient products, as indicated above, can be that the usage has not resulted in decline in electricity bill. Though a large number of consumers feel that use of energy-efficient appliances has resulted in definitive gains in terms of reduction in electricity bills (Table 5.45); more than 35 percent consumers indicated that it has either not resulted in decline in electricity bills or they are not aware of it.

Table 5.45: Whether Use of EE Products Has Led to Decline in Electricity Bill?		
	Frequency	*Percent*
Yes	7124	64.8
No	1165	10.6
Do not know	2700	24.6
Total	10989	100.0

Over 40 percent consumers (who said use of energy-efficient products has led to decline in electricity bills) are of the opinion that their electricity bills have declined in the range

of five to 10 percent as a result of use of energy-efficient appliances (Table 5.46). For another about 35 percent consumers, the decline is in the range of up to five percent. What is, however, more important is that energy-efficient products have resulted in a saving of more of 10 percent in electricity bills for over one-fifth of users. Such results need to be further probed as to whether this is because of shift from non-energy-efficient to high star (5 star) products.

Table 5.46: Decline in Electricity Consumption as a Result of Use of EE Products

	Frequency	*Percent*
Those who said use of energy efficient products has led to less electricity bills	7124	100.0
No response	211	3.0
Up to 5%	2466	34.6
5-10%	2857	40.1
Over 10%	1590	22.3

Energy-efficient Appliance Market Suffers from Lack of Integration

The market (demand and supply-side forces) seemingly does not appear to be fully integrated. This is especially in the case of post-sales interaction between consumers and suppliers (traders). On the question of sharing of feedback with consumers, only a little over one-third of traders indicated that they received post-sales feedback from consumers. About two-third of the traders did not receive any feedback (Table 5.47).

Data analysis also indicates that not all feedbacks have been passed on to producers. Only about one-fourth of traders who received consumer feedbacks passed on these to producers (Table 5.48).

Table 5.47: Did Traders Receive Any Feedback from Customers on Energy Efficiency?		
	Frequency	*Percent*
Yes	200	36.3
No	351	63.7
Total	551	100.0

Table 5.48: Was the Feedback Communicated to the Producers?		
	Frequency	*Percent*
Yes	137	24.9
No	63	11.4
Total	200	36.3
Respondents who did not receive feedbacks from consumers	351	63.7
Total	551	100.0

Energy Efficiency Yet to Become a Motivating Factor

As indicated earlier, energy efficiency does not appear to be a motivating factor for purchase of energy-efficient products. This is further reinforced by traders' perception. Less than one-sixth of traders indicated that consumers value energy efficiency for buying appliances. Brand name, up-front

Table 5.49: Traders' Perception of What Consumer Values while Purchasing Electrical Appliances? (MA)		
	Frequency	*Percent*
Up-front cost	155	20
Energy efficiency	113	15
Life expectancy	144	19
Warranty	115	15
Brand name	232	30
Others	7	1
Total	766	100

cost and life expectancy are the major motivating factors that influence consumers' purchase decisions (Table 5.49).

Lack of energy efficiency as a motivating factor appears to have its impact on consumers' willingness to switching to such appliances. Of the 45 percent respondents who are not users of energy efficient products, 28 percent are of the opinion that they have problem in switching to energy-efficient products (Table 5.50). The reasons cited for this reluctance are many. Products being too expensive and little knowledge about operation are the two most important reasons revealed by respondents. Inaccessibility to energy-efficient products is another important reason (Table 5.51).

Table 5.50: Problems in Switching to Energy-efficient Products

	Frequency	*Percent*
Already have energy efficient products in household	10989	54.5
Yes	5677	28.2
No	3500	17.4
Total	20166	100.0

Table 5.51: Type of Problem in Switching to Energy-efficient Products (MA)

	Frequency	*Percent*
Too expensive	2417	34
Energy efficient (EE) products not readily available in the market	1502	21
Retailers are unaware of EE products	980	14
Little knowledge about its operation	1921	27
Others	261	4
Total	7081	100

It is observed that joint family has a clear edge over nuclear family in both ownership and its willingness to shift to energy-efficient products (Table 5.52). The analysis shows that, while over three-fifths of respondents in joint families own energy-efficient appliances, only 22, a little over one-fifth, show their reluctance to completely shift to energy-efficient products. This is in sharp contrast to nuclear family in which case while less than half use energy- efficient products, a larger number of people show reluctance to completely shift to energy efficient products.

Table 5.52: Type of Family and Problems in Switching to Energy-efficient Products

		Type of Family		Total
		Nuclear	Joint	
Already have energy efficient products in household	Frequency %	6130 49.1	4859 63.3	10989 54.5
Yes	Frequency %	3972 31.8	1705 22.2	5677 28.2
No	Frequency %	2389 19.1	1111 14.5	3500 17.4
Total	**Frequency**	**12491**	**7675**	**20166**

Data clearly reflect that for both types of families, energy-efficient products, being too expensive and little knowledge about their operation, are the two most-important reasons which make them reluctant to completely shift to energy-efficient products (Table 5.53). However, a bigger percentage of people (nearly two-fifths) in joint family opined that high product price is the main reason for their reluctance. Another important observation that emerges from the analysis is that across both the types of families, a similar percentage of respondents said that retailers have little, or inadequate, knowledge and this is also one of the reasons.

Table 5.53: Family Type and Types of Problems Faced in Switching to Energy-efficient Products (MA)

		Type of Family		Total
		Nuclear	Joint	
Too expensive	Frequency %	1565 32	852 39	2417 34
Energy Efficient (EE) Products Not Readily Available in the market	Frequency %	1140 23	362 17	1502 21
Retailers are unaware of EE products	Frequency %	697 14	283 13	980 14
Little knowledge about its operation	Frequency %	1345 27	576 27	1921 27
Others	Frequency %	173 4	88 4	261 4
Total	**Frequency**	**4920**	**2161**	**7081**

The Table below (Table 5.54) establishes a clear relationship between income level and problems faced in switching to energy-efficient products. A higher percentage of consumers in the higher income group indicated that it has no problem in switching to energy-efficient products, compared

Table 5.54: Income Level and Problems Faced in Switching to Energy-efficient Products

		Income Level						Total
		Did not respond	Up to 10,000	10,001-20,000	20,001-40,000	40,001-75,000	75,001 and above	
Already have energy efficient products in household	Frequency %	2 -	4357 43.4	3859 60.2	2287 74.2	353 76.4	131 78.0	10989 54.5
Yes	Frequency %	0 -	3538 35.2	1537 24.0	517 16.8	68 14.7	17 10.1	5677 28.2
No	Frequency %	0 -	2145 21.4	1017 15.9	277 9.0	41 8.9	20 11.9	3500 17.4
Total	**Frequency**	**2**	**10040**	**6413**	**3081**	**462**	**168**	**20166**

to those in the lower income bracket. Percentage of people showing reluctance to completely shifting to energy-efficient products shows a declining trend with income levels: only 10 percent people in the income group of over ₹75,000 are reluctant, compared to 35 percent people in the income group of ₹10,000.

As above, a relatively larger number of people across different income levels give products being too expensive as the primary reason for their reluctance to shift to energy-efficient products (Table 5.55). There is, however, one exception. In the case of people in the income group of M40,001-75,000, it is observed that little knowledge about operation is the primary reason. Inaccessibility and traders' lack of proper awareness are other important reasons cited.

Table 5.55: Income Level and Types of Problem Faced in Switching to Energy-efficient Products (MA)

		Income Level						Total
		Did not respond	Up to 10,000	10,001-20,000	20,001-40,000	40,001-75,000	75,001 and above	
Too expensive	Frequency	-	1479	708	204	21	5	2417
	%	-	34	36	32	27	29	34
Energy-efficient (EE) products not readily available in the market	Frequency	-	966	414	106	12	4	1502
	%		22	21	17	15	24	21
Retailers are unaware of EE products	Frequency	-	597	247	115	17	4	980
	%	-	14	13	18	22	24	14
Little knowledge about its operation	Frequency	-	1136	553	199	29	4	1921
	%		26	28	32	37	24	27
Others	Frequency		207	49	5			261
	%		5	2	1	0	0	4
Total	**Frequency**	**0**	**4385**	**1971**	**629**	**79**	**17**	**7081**

Use of energy-efficient products is more common to people engaged in businesses, as is reflected by Table below (Table 5.56). While more than three-fifths of these people own such products, another about 14 percent shows its willingness to completely shift to energy efficient products. In contrast, a good percentage of people (one-fourth) also show reluctance to completely shift to energy-efficient products. This segment appears to be better placed than those in services and much above people engaged in farming.

Table 5.56: Occupation and Problems in Switching to Energy Efficient Products

		Occupation					Total
		Did not Respond	Service	Business	Farming	Others	
Already have energy efficient products in household	Frequency %	12 -	4052 55.2	3472 61.0	1827 43.2	1629 56.4	10989 54.5
Yes	Frequency %	0 -	2055 28.0	1431 25.1	1333 31.5	858 29.7	5677 28.2
No	Frequency %	- -	1234 16.8	793 13.9	1069 25.3	401 13.9	3500 17.4
Total	**Frequency**	**12**	**7341**	**5696**	**4229**	**2888**	**20166**

There is not much variation even when one links problems of shifting to energy-efficient appliances with occupations. A majority of people across different occupations are of the view that products being too expensive and little knowledge about their operations are the two major problems faced by them (Table 5.57).

Table 5.57: Occupation and Types of Problems Faced in Switching to Energy-efficient Products (MA)

		Occupation					Total
		Did not Respond	Service	Business	Farming	Others	
Too expensive	Frequency	0	764	549	635	469	2417
	%	-	31	31	37	41	34
Energy efficient (EE) products not readily available in the market	Frequency	0	575	368	351	208	1502
	%	-	24	21	20	18	21
Retailers are unaware of EE products	Frequency	0	382	287	181	130	980
	%	-	16	16	10	11	14
Little knowledge about its operation	Frequency	0	664	505	507	245	1921
	%	-	27	29	29	21	27
Others	Frequency		59	38	64	100	261
	%	-	2	2	4	9	4
Total	**Frequency**	**0**	**2444**	**1747**	**1738**	**1152**	**7081**

Supply-side Issues Disclosed by Traders and Producers

Besides the problems faced on the demand side by consumers, there are also issues and problems faced on the supply side. Nearly two-fifths of the traders surveyed under this project said that they face problems of different types in promoting sales of energy-efficient products (Table 5.58).

According to a majority of traders who face sales problems, high upfront cost of products is a major problem hampering promotion of energy-efficient products. This is distantly followed by buyers' lack of information. What is, however, more important is that more than one-fifth of traders said that lack of training among traders is also a reason that hinders sales promotion of energy-efficient products (Table 5.59).

Table 5.58: Problems Faced by Traders in the Sale of EE Items		
	Frequency	*Percent*
Yes	212	38.5
No	339	61.5
Total	**551**	**100.0**

Table 5.59: Types of Problems Faced by Traders in Sales of EE Products (MA)		
	Frequency	*Percent*
Lack of formal training in the sale of energy efficient appliances	53	21
Buyers lack of information regarding purchase and use of appliance	68	27
High upfront cost for consumers	126	50
Others	3	1
Total	**250**	**100**

A similar view is echoed by a section of producers also (Table 5.60). Out of 50 producers covered under this study, five producers face problems in marketing of energy-efficient products (for linkage between type of ownership and marketing problem faced, refer to Annexures 5.13, 5.14, 5.15 and 5.16). And, these problems are confined to two areas: high upfront product cost to consumers and retailers' lack of information.

Opinions of consumers and traders converge on high upfront cost as one of the main hindrances to sales of energy efficient products. The situation is different in case of producers. It is observed that only three out of 50 producers indicated that high up front cost is a major problem in sales of energy efficient products. It is, therefore, difficult to draw any conclusion about producers' on the types of problem faced by them.

Table 5.60: Producers' Perception of Problems Faced in Marketing of EE Products		
	Frequency	*Percent*
Yes	5	10.0
No	45	90.0
Total	**50**	**100.0**

Table 5.61: Producers' Perception of Type of Problems Faced by Producers in marketing of EE Products	
	Frequency
High upfront cost for consumers	3
Retailers' lack of information regarding energy efficient appliances	2
Total	**5**

Traders appear to have low incentive to promote sales of energy-efficient products. This is revealed by about two-third traders included in the survey (Table 5.62). A similar observation can be made in case of producers also (Table 5.63). Out of 50 producers covered, 49 made a similar remark that they do not have any incentive so far either from the State or Central Governments. The incentive in one case came in the form of recognition (Table 5.64), which does not look good enough to incentivise producers.

Table 5.62: Whether Traders Received Any Incentives for Selling EE Products?		
	Frequency	*Percent*
Yes	193	35.0
No	358	65.0
Total	**551**	**100.0**

Table 5.63: Whether Producers Availed Any Production-related Incentives from Both the Local and National-level Governments		
	Frequency	*Percent*
Yes	1	2.0
No	49	98.0
Total	**50**	**100.0**

Table 5.64: Types of Incentives		
	Frequency	*Percent*
No response	49	98.0
Recognition/award	1	2.0
Total	**50**	**100.0**

Removal of Barriers to Increasing Acceptance of Energy-efficient Products

A number of demand and supply-side barriers hindering promotion of energy-efficient products are observed. Some of these include low level of awareness, high product price, lack of incentives to supply-side players and others. Respondents were asked and were given multiple options on how these barriers can be removed to facilitate greater acceptance of energy-efficient products.

To a large number of consumers, reduction in cost and/or price of energy-efficient products can work as a stimulus to increased acceptance of these products by consumers (Table 5.65). Together with subsidisation of energy-efficient products, it constitutes more than two-thirds of consumers who expressed this view. There is also need to increase awareness about such products, about 30 percent of consumers feel.

Table 5.65: Consumers' Perception of How Barriers to EE Products Can Be Removed (MA)

	Frequency	*Percent*
Subsidisation of energy-efficient products	6985	29
Reduction in cost/price of energy-efficient products	9198	38
Generating Awareness about them	6945	29
Others	985	4
Total	24113	100

A similar pattern is observed when one relates ways of removal of barriers with the family type. Respondents in both types of families share a similar view, with the largest number of respondents saying that reduction in cost and or price of these products can increase the level of acceptance among consumers. They give almost equal weightage to all the three measures (Table 5.66).

Table 5.66: Family Type and How Barriers to EE Products Can Be Removed (MA)				
		Type of Family		Total
		Nuclear	Joint	
Subsidisation of energy-efficient products	Frequency	4181	2804	6985
	%	29	29	29
Reduction in cost/ price of energy-efficient products	Frequency	5513	3685	9198
	%	38	38	38
Through generating awareness about them	Frequency	4014	2931	6945
	%	28	30	29
Others	Frequency	708	277	985
	%	5	3	4
Total	**Frequency**	**14416**	**9697**	**24113**

Table 5.67 gives a clear indication that consumers in different income groups give varying opinions on how barriers to greater acceptance of energy-efficient products can be removed. For a larger number of respondents in all income groups, reduction in products' cost/ price and subsidisation

Table 5.67: Income Level and How Barriers to EE Products Can Be Removed (MA)								
		Income Level						Total
		Did not Respond	Up to 10,000	10,001-20,000	20,001-40,000	40,001-75,000	75,001 and above	
Subsidisation of energy-efficient products	Frequency	-	3475	2175	1038	199	98	6985
	%	-	29	28	29	34	44	29
Reduction in cost prices of energy-efficient products	Frequency	-	4287	3093	1473	251	94	9198
	%	-	36	39	41	43	42	38
Through generating awareness about them	Frequency	-	3558	2207	1022	127	31	6945
	%	-	30	28	28	22	14	29
Others	Frequency	-	496	401	81	6	1	985
	%	-	4	5	2	1	0	4
Total	**Frequency**	**-**	**11816**	**7876**	**3614**	**583**	**224**	**24113**

continue to be the two most important tools. While lower income groups give more weightage to reduction in cost/price, people in higher income groups give more importance to subsidisation of energy-efficient products.

The Table also demonstrates that emphasis on awareness generation varies significantly from one income group to another. Less than 15 percent respondents in the highest income group (over ₹75,000) emphasise the need for generating greater awareness. The percentage of people who expressed similar opinion declines with every increase in income level. This implies that people in the higher income bracket are more aware of energy-efficient products, compared to lower income groups.

A larger segment of consumers in different occupations appears to give highest weightage to reduction in cost/price of energy-efficient products (Table 5.68). Reduction in cost/price can work as a motivation for consumers to go for energy-efficient products, said a large number of consumers, encompassing different occupations. This is closely followed

Table 5.68: Occupation and How Barriers to EE Products Can Be Removed (MA)

		Occupation					Total
		Did Not Respond	Service	Business	Farming	Others	
Subsidisation of energy-efficient products	Frequency	-	2534	2089	1673	689	6985
	%	-	30	30	33	19	29
Reduction in cost prices of energy-efficient products	Frequency	-	3313	2778	1733	1374	9198
	%	-	39	40	34	38	38
Through generating awareness about them	Frequency	-	2236	1878	1495	1336	6945
	%	-	27	26	29	38	29
Others	Frequency	-	367	274	161	183	985
	%	-	4	4	4	5	4
Total	**Frequency**	-	**8450**	**7019**	**5062**	**3582**	**24113**

by the need for subsidisation of energy-efficient products. However, it is also observed that consumers in some occupations, such as plumbers, carpenters, etc. expressed need for generating awareness as a tool of enhancing acceptance of these products.

Consumers' Perception of the Need to Market Only Energy-efficient Products

Every seven in ten consumers surveyed expressed that there is need to market only energy-efficient products. Traders should be facilitated to market only energy-efficient products, opined more than two-thirds of consumers (Table 5.69). This expression is consistent with data on the percentage of people having awareness of energy-efficient products.

Table 5.69: Consumers' Perception of the Need to Market Only EE Products by Retailers

	Frequency	*Percent*
Yes	14140	70.1
No	6026	29.9
Total	20166	100.0

Joint family consumers have an edge over nuclear family consumers, as a bigger percentage of them were of the opinion that traders should market only energy-efficient products (Table 5.70).

Table 5.70: Type of Family and Consumers' Perception That Retailers Need to Market Only Energy-efficient Products

		Type of Family		
		Nuclear	Joint	Total
Yes	Frequency	8526	5614	14140
	%	68.3	73.1	70.1
No	Frequency	3965	2061	6026
	%	31.7	26.9	29.9
Total	**Frequency**	**12491**	**7675**	**20166**

Consumers' income levels and their perception of the need for marketing energy-efficient products appear to have a positive relationship. This is reflected by the fact that, with every increase in the level of income, the percentage of people who expressed the need for marketing only energy-efficient products by traders increases (Table 5.71). In the top income group (over M75,000), nine in every ten consumers expressed similar opinion.

Table 5.71: Income Level and Consumers' Perception That Retailers Need to Market Only Energy-efficient Products

		Income Level						Total
		Did not Respond	Up to 10,000	10,001-20,000	20,001-40,000	40,001-75,000	75,001 and above	
Yes	Frequency	1	6931	4274	2403	377	154	14140
	%	-	69.0	66.6	78.0	81.6	91.7	70.1
No	Frequency	1	3109	2139	678	85	14	6026
	%	-	31.0	33.4	22.0	18.4	8.3	29.9
Total	**Frequency**	**2**	**10040**	**6413**	**3081**	**462**	**168**	**20166**

Except in the farming segment, over 70 percent of respondents in all other occupations expressed the need for marketing of only energy-efficient products by traders. Even in the farming class, respondents who expressed similar views were more than 60 percent. This can be considered as a very important development as far as the drive for promotion of energy efficient-products is concerned. At the same time, it

Table 5.72: Occupation and Consumers' Perception That Retailers Need to Market Only Energy-efficient Products

		Occupation					Total
		Did Not Respond	Service	Business	Farming	Others	
Yes	Frequency	-	5295	4134	2640	2063	14140
	%	-	72.1	72.6	62.4	71.4	70.1
No	Frequency	-	2046	1562	1589	825	6026
	%	-	27.9	27.4	37.6	28.6	29.9
Total	**Frequency**	**12**	**7341**	**5696**	**4229**	**2888**	**20166**

also reflects the need of educating farmers about the usefulness and, more importantly, the benefits that could emerge from usage of such products (Table 5.72).

Willingness to Completely Shift to Energy-efficient Products in Future

Nearly two-third consumers gave a clear indication that they can completely shift to energy-efficient products in near future (Table 5.73). The situation does not change much even when one relates consumers' willingness to completely shift to energy efficient products with family type. This is one issue on which consumers from both nuclear and joint families came out with almost similar expression. In both types of families, over three-fifths of respondents said that they can shift to these products in future (Table 5.74).

Table 5.73: Consumers' Plan to Completely Shift to EE Products in Future

	Frequency	*Percent*
Yes	12905	64.0
No	7261	36.0
Total	20166	100.0

Table 5.74: Type of Family and Consumers' Plan to Completely Shift to EE Products in Future

		Type of Family		
		Nuclear	Joint	Total
Yes	Frequency	7895	5010	12905
	%	63.2	65.3	64.0
No	Frequency	4596	2665	7261
	%	36.8	34.7	36.0
Total	Frequency	12491	7675	20166

As also observed in the case of awareness and usage of energy-efficient products, consumers with higher income levels have greater willingness to completely shift to such products in future. Nearly eight in every ten consumers in the highest

income bracket (over ₹75,000) indicated this. This willingness declines with every decline in income level. A lower percentage of consumers in the lowest income group (less than ₹10,000) expressed this (Table 5.75).

Table 5.75: Income Level and Consumers' Plan to Completely Shift to EE Products in Future

		Income Level						Total
		Did not Respond	Up to 10,000	10,001-20,000	20,001-40,000	40,001-75,000	75,001 and above	
Yes	Frequency	-	5975	4277	2171	349	131	12905
	%	-	59.5	66.7	70.5	75.5	78.0	64.0
No	Frequency	-	4065	2136	910	113	37	7261
	%	-	40.5	33.3	29.5	24.5	22.0	36.0
Total	**Frequency**	**2**	**10040**	**6413**	**3081**	**462**	**168**	**20166**

About two-third respondents in all the occupations expressed their plans to completely shift to energy-efficient products in future (Table 5.76). One exception to this is consumers engaged in farming activities. However, even in this case, consumers with such plans are quite high, about 57 percent.

Table 5.76: Occupation and Consumers' Plan to Completely Shift to EE Products in Future

		Occupation					Total
		Did Not Respond	Service	Business	Farming	Others	
Yes	Frequency	-	4829	3702	2390	1976	12905
	%	-	65.8	65.0	56.5	68.4	64.0
No	Frequency	-	2512	1994	1839	912	7261
	%	-	34.2	35.0	43.5	31.6	36.0
Total	**Frequency**	**12**	**7341**	**5696**	**4229**	**2888**	**20166**

Consistent with earlier observations on consumers' perception on barriers to energy efficiency and how these can be removed, reduction in electricity bills has emerged as the most important motivation for consumers to completely shift

Table 5.77: Factors That Motivate Consumers to Shift to EE Products (MA)		
Source	*Frequency*	*Percent*
Environmental protection factor	2960	19
Reduction in electricity bill	9096	59
Sense of responsibility	3051	20
Others	184	1
Total	15291	100

to energy-efficient products. This is expressed by six in every ten consumers. A sense of responsibility and environmental factors are other two motivations cited by consumers (Table 5.77).

Consumers' plan to completely shift to energy-efficient products appears to be duly supported by producers' perception. More than two-thirds (or about seven in every ten) of producers are of the opinion that there is need to formulate policies that promote sales of energy-efficient products only (Table 5.78). Observations emerging from consumers and producers' data are indicative of the emerging market for energy-efficient products in the coming period.

Broadening of product range has now become crucial. This is revealed by producers' perception. There is also need to not only formulate policies that promote production of energy-efficient products only but also a bigger need to broaden the product range, feel 96 percent (at least nine in every 10) producers (Table 5.79) (for more details, refer to Annexure 5.5). Two important reasons for broadening product range, as indicated by the producers, are that it might lead to

Table 5.78: Producers' Perception of the Need to Formulate Polices That Promote Production of Only EE Products		
	Frequency	*Percent*
Strongly agree	14	28.0
Agree	34	68.0
Indifferent	2	4.0
Total	50	100.0

production of more energy-efficient products and thus lead to more energy saving and it might lead to more competition and thus reduction in product prices (Table 5.80 and Annexures 5.17, 5.18, 5.19 and 5.20).

Table 5.79: Producers' Perception of the Need Not Only to Switch to Production but Also Broaden the Range of Choices of EE Products

	Frequency	*Percent*
Strongly agree	16	32
Agree	34	68
Indifferent	0	0
Disagree	0	0
Don't know	0	0
Total	50	100

Table 5.80: Reasons Given by Producer for Broadening of EE Product Range

Reason	*Frequency*	*Percent*
It will give more options to consumers	17	14
It will lead to more competition and hence decline in price	37	30
It will help in saving electricity	45	37
It will help in reducing pollution levels and saving environment	24	20
Others		0
Total	123	100

Despite a majority of producers opining that there is need to formulate policies that promote energy-efficient products only and those who said there is need to broaden product range, only five out of 50 producers (or say 10 percent) show their willingness to completely shift to production of energy-efficient products (Table 5.81 and for more details see Annexee 5.21). A big number of these producers indicated that their shift would depend on market situation. These producers would go for a shift only when the situation is conducive for this.

Table 5.81: Producers' Future Plan for EE Products		
	Frequency	*Percent*
A complete shift to production of energy efficient products in the next 5 years	5	10.0
Production depends upon market situation	39	78.0
Production depends upon government policies	6	12.0
Total	50	100.0

Consumer Willingness to Pay Premium

In a situation where product cost and price factors are seemingly major determinants of the demand for energy-efficient products, as revealed by a majority of consumers, traders and producers, willingness to pay extra price or premium for such products becomes crucial.

Nearly 57 percent of consumers expressed their willingness to pay extra for products which use less energy and are user-friendly (Table 5.82). This positive development may be the culmination of various other developments, such as increased awareness about the need to save and conserve energy, supported by increased affordability resulting from increased per capita income. Almost a similar percentage of consumers are using energy-efficient products. One can, thus, argue that willingness to pay is high among consumers who are already using such products.

Table 5.82: Consumers' Willingness to Pay More for Energy-efficient Products		
	Frequency	*Percent*
Willing to pay more for energy efficient products	11415	100
Yes	11415	56.6
No	8751	43.4
Total	20166	100.0

Willingness to pay premium is almost equal in both nuclear and joint families, with the latter having a slight edge over the former (Table 5.83). This situation is different when one relates willingness to pay premium with income levels. It is observed that income levels have positive relationship with willingness to pay: the higher the income, the higher the willingness to pay. There is, however, one exception. In the case of consumers in the income bracket of over M75,000, a lower percentage of people show their willingness to pay premium (Table 5.84). This might be because of the income effect – higher affordability.

Table 5.83: Type of Family and Consumers' Willingness to Pay More for EE Products

		Type of Family		
		Nuclear	Joint	Total
Yes	Frequency	7022	4393	11415
	%	56.2	57.2	56.6
No	Frequency	5469	3282	8751
	%	43.8	42.8	43.4
Total	**Frequency**	**12491**	**7675**	**20166**

Table 5.84: Income Level and Consumers' Willingness to Pay More for EE Products

		Income Level						
		Did not Respond	Up to 10,000	10,001-20,000	20,001-40,000	40,001-75,000	75,001 and above	Total
Yes	Frequency	-	5128	3857	2030	305	93	11415
	%	-	51.1	60.1	65.9	66.0	55.4	56.6
No	Frequency	-	4912	2556	1051	157	75	8751
	%	-	48.9	39.9	34.1	34.0	44.6	43.4
Total	**Frequency**	**2**	**10040**	**6413**	**3081**	**462**	**168**	**20166**

Consumers engaged in businesses show greater willingness to pay premium than consumers in other occupations. They are closely followed by service class and consumers in other occupations (Table 5.85). A relatively lower percentage of

Table 5.85: Occupation and Consumers' Willingness to Pay More for EE Products							
		Occupation					
		Did Not Respond	Service	Business	Farming	Others	Total
Yes	Frequency	9	4241	3418	2026	1721	11415
	%	75.0	57.8	60.0	47.9	59.6	56.6
No	Frequency	3	3100	2278	2203	1167	8751
	%	25.0	42.2	40.0	52.1	40.4	43.4
Total	**Frequency**	**12**	**7341**	**5696**	**4229**	**2888**	**20166**

people in the farming occupation showed their willingness to pay premium for energy-efficient products.

Willingness to pay premium varies across different segments of consumers, as indicated by Tables below. Out of those who indicated their willingness to pay extra, seven out of every ten agreed to pay in the range of up to 10 percent. Only a little over one-fifth showed their willingness to pay in the range of 10 to 20 percent. The percentage declines further with raising the premium bar (Table 5.86). The willingness was significantly low for products with prices 20 percent above the non-energy efficient products, with less than one in ten agreeing to pay.

Table 5.86: Segregation of Consumers in Terms of Their Willingness to Pay More for EE Products		
	Frequency	*Percent*
Willing to pay more for energy efficient products	**11415**	**100**
Up to 10% above the marked price of traditional products	8269	72.5
10 - 20% above the marked price of traditional products	2429	21.3
Over 20%	717	6.2

Out of total consumers in the joint family category who are willing to pay extra for energy-efficient products, about 74 percent indicated their willingness to pay in the range of only up to 10 percent. Only two in ten consumers in this segment agreed to do so in the 10 to 20 percent range (Table 5.87). Another important observation is that a relatively higher percentage of consumers in joint family are willing to pay extra in the range of over 20 percent.

Table 5.87: Type of Family and Consumers' Willingness to Pay More for EE Products				
		Type of Family		
		Nuclear	Joint	Total
Willing to pay more for energy efficient products	Frequency	7022	4393	11415
Up to 10% above the marked price of traditional products	Frequency	5030	3239	8269
	%	71.6	73.7	72.4
10 - 20% above the marked price of traditional products	Frequency	1525	904	2429
	%	21.7	20.6	21.3
Over 20%	Frequency	467	250	717
	%	3.7	5.7	6.3

It is observed that willingness to pay extra in the range of over 20 percent is high in consumers of higher income groups especially in over M75,000 segment (Table 5.88). Data also demonstrate that a lower percentage of consumers in the income group of M40,000 to 75,000 show its willingness to pay extra in the range of over 20 percent, compared to consumers lower income groups. The actual reason for this needs to be explored further.

Table 5.88: Income Level and Consumers' Willingness to Pay More for EE Products								
		Income Level (INR)						Total
		Did not respond	Up to 10,000	10,001-20,000	20,001-40,000	40,001-75,000	75,001 and above	
Willing to pay more for energy efficient products	Frequency	2-	5128	3857	2030	305	93	11415
Up to 10% above the marked price of traditional products	Frequency	-	3691	2724	1540	240	72	8269
	%	-	72.0	70.6	75.9	78.7	77.4	72.4
10 - 20% above the marked price of traditional products	Frequency	-	1145	855	365	54	10	2429
	%	-	22.3	22.2	18.0	17.7	10.7	21.3
Over 20%	Frequency	-	292	278	125	11	11	717
	%	-	5.7	7.2	6.1	3.6	11.8	6.3

In every occupation, consumers willing to pay extra in the range of up to 10 percent constitute the largest group. This is as high as seven out of every ten consumers. However, a relatively larger percentage of consumers engaged in farming show their willingness to pay extra in this range (Table 5.89). As far as willingness to pay extra in the highest range (over 20 percent) is concerned, consumers in other occupations (or in petty businesses) show relatively higher willingness, followed by consumers in services and businesses.

Table 5.89: Occupation and Consumers' Willingness to Pay More for EE Products

		Occupation					
		Did Not Respond	Service	Business	Farming	Others	Total
Willing to pay more for energy efficient products	Frequency	9	4241	3418	2026	1721	11415
Up to 10% above the marked price of products traditional	Frequency	-	3071	2470	1495	1226	8269
	%	-	72.4	72.3	73.8	71.2	72.4
10 - 20% above the marked price of traditional products	Frequency	-	899	738	422	368	2429
	%	-	21.2	21.3	20.8	21.4	21.3
Over 20%	Frequency	-	271	210	109	127	717
	%	-	6.4	6.4	5.4	7.4	6.3

The above analysis is indicative of the general understanding that consumers show their reluctance to pay higher for energy-efficient products. With every increase in premium (extra price), the percentage of consumers showing their willingness declines. This is further reinforced by consumers' consideration for product cost. Almost three-fourths of consumers indicated that they consider cost as a purchase-determining criterion (Table 5.90).

Table 5.90: Consumers' Cost Consideration for Use of Electrical Appliances		
	Frequency	*Percent*
Yes	14939	74.1
No	5227	25.9
Total	20166	100.0

Usage Pattern of Electrical Appliances

Electrical appliances are used differently by different types of consumers and usage trend varies for each of the products, based on type of family, income levels and occupations. A product-wise usage pattern is presented in the Table below (Table 5.91). The Table shows season-wise trend in terms of duration of use and also shows that the same product is used differently in different seasons.

In the case of refrigerators, data indicates that this product is used throughout the year. However, it has seasonality effect. Consumers who use refrigerator for more than 18 hours are relatively more concentrated in summer season. In the 12-18 hour user group, the product is used by the relatively bigger percentage of consumers in rainy season. Compared to this, a bigger percentage of consumers in the 2-6 hour and 6-12 hour user groups are found to be concentrated in winter season. Use of lights (CFLs/tube lights) appears to be more evenly distributed across different seasons, as not much variation in use is observed.

Air conditioners are used mainly in summers by consumers in different users groups, with one exception. In the 0-2 hour user category, air conditioners use is evenly distributed. In all remaining categories, product use is concentrated in summer, distantly followed by rainy and almost negligible use in winter season.

Television and LCDs appear to have a similar usage pattern. Their use is spread throughout the year. The data do not reveal any user in the over 18 hour user category.

There are only two user groups in the case of washing machine, dishwasher and iron. The product is used for 0-2 hours and 2-6 hours in different seasons. However, while the use of washing machine across seasons is almost evenly distributed, in other two cases, significant variations are observed. Use of iron is mostly concentrated in summer and is used for 2-6 hours and use of dishwasher for longer hours is concentrated in rainy season.

Use of geyser is evenly distributed among the 0-2 hour user groups and across seasons. However, those who use the product for over 12-18 hours and above are concentrated in the summer season.

Though fans are used mainly in summer seasons, but its usage extends to cover other seasons as well. Nearly two-thirds of the users who use fans for 12-18 hours and above are found in summer season. Of those who use fans for 0-2 hours, a majority of them use it in winter. In the case of microwave, it is observed that its use is more concentrated in summer for 6-12 and 12-18 hour groups. The product is used by some consumers for over 18 hours in winter season.

Use of food processors and mixer-grinders is mainly by two user groups – 0-2 hour and 2-6 hour user groups. It is observed that in other groups, the usage of food processor is confined to summer (12-18 hour user group) and mixer-grinder use is confined to rainy season among 6-12 hour user group.

Table 5.91: Usage Pattern of Electrical Appliances

Appliances	Hours of Usage	Summer	Winter	Rainy	Total
Refrigerators	0-2 hours	33%	34%	33%	100%
	2-6 hours	20%	49%	31%	100%
	6-12 hours	23%	43%	34%	100%
	12-18 hours	29%	30%	40%	100%
	Above 18 hours	40%	29%	31%	100%
Lights					
Bulbs/CFLs	0-2 hours	33%	30%	37%	100%
	2-6 hours	33%	33%	34%	100%
	6-12 hours	34%	34%	32%	100%
	12-18 hours	31%	34%	34%	100%
	Above 18 hours	35%	35%	31%	100%
Tube lights	0-2 hours	33%	33%	34%	100%
	2-6 hours	34%	33%	32%	100%
	6-12 hours	34%	34%	32%	100%
	12-18 hours	27%	32%	40%	100%
	Above 18 hours	33%	33%	33%	100%
Air Conditioners	0-2 hours	32%	34%	33%	100%
	2-6 hours	46%	11%	43%	100%
	6-12 hours	68%	18%	15%	100%
	12-18 hours	88%	0%	12%	100%
	Above 18 hours	60%	20%	20%	100%
Geysers	0-2 hours	33%	33%	33%	100%
	2-6 hours	0%	24%	76%	100%
	6-12 hours	27%	36%	36%	100%
	12-18 hours	100%	0%	0%	100%
	Above 18 hours	100%	0%	0%	100%
Fans	0-2 hours	4%	79%	17%	100%
	2-6 hours	28%	22%	50%	100%
	6-12 hours	48%	13%	39%	100%
	12-18 hours	65%	3%	32%	100%
	Above 18 hours	68%	1%	31%	100%
TVs	0-2 hours	32%	34%	34%	100%
	2-6 hours	33%	33%	34%	100%
	6-12 hours	35%	34%	30%	100%
	12-18 hours	29%	31%	41%	100%
	Above 18 hours	—	—	—	—
LCDs	0-2 hours	33%	33%	33%	100%
	2-6 hours	34%	32%	34%	100%
	6-12 hours	35%	34%	30%	100%
	12-18 hours	10%	10%	80%	100%
	Above 18 hours	—	—	—	—

Contd...

Appliances	Hours of Usage	Summer	Winter	Rainy	Total
Washing machines	0-2 hours	33%	33%	33%	100%
	2-6 hours	31%	34%	34%	100%
	6-12 hours	—	—	—	—
	12-18 hours	—	—	—	—
	Above 18 hours	—	—	—	—
Microwave ovens	0-2 hours	33%	33%	33%	100%
	2-6 hours	0%	67%	33%	100%
	6-12 hours	100%	0%	0%	100%
	12-18 hours	100%	0%	0%	100%
	Above 18 hours	0%	100%	0%	100%
Food processors	0-2 hours	33%	33%	33%	100%
	2-6 hours	0%	25%	75%	100%
	6-12 hours	—	—	—	—
	12-18 hours	100%	0%	0%	100%
	Above 18 hours	—	—	—	—
Mixer-grinder	0-2 hours	33%	33%	33%	100%
	2-6 hours	25%	35%	40%	100%
	6-12 hours	0%	0%	100%	100%
	12-18 hours	0%	—	—	—
	Above 18 hours	0%	0%	—	—
Irons	0-2 hours	33%	33%	33%	100%
	2-6 hours	77%	10%	13%	100%
	6-12 hours	—	—	—	—
	12-18 hours	—	—	—	—
	Above 18 hours	—	—	—	—
Water/irrig. pumps	0-2 hours	33%	33%	33%	100%
	2-6 hours	42%	27%	31%	100%
	6-12 hours	36%	40%	24%	100%
	12-18 hours	36%	18%	45%	100%
	Above 18 hours	40%	20%	40%	100%
Dishwashers	0-2 hours	33%	33%	33%	100%
	2-6 hours	0%	29%	71%	100%
	6-12 hours	—	—	—	—
	12-18 hours	—	—	—	—
	Above 18 hours	—	—	—	—
Others (Coolers, computers,	0-2 hours	33%	34%	33%	100%
music systems & charger	2-6 hours	32%	15%	52%	100%
lights, etc.)	6-12 hours	44%	1%	55%	100%
	12-18 hours	—	—	—	—
	Above 18 hours	—	—	—	—

Summing Up and Conclusion

A number of interesting and useful observations emerge from the field data on how electrical home appliances are used and emerging opportunities and challenges. Some of the important observations include: ownership pattern and trend in penetration/upgradation; electricity consumption by these appliances; what consumers think about energy efficiency and their awareness on energy-efficient products; challenges/barriers faced by consumers and how these can be overcome; and others.

Most interestingly, the survey also shed light on consumers' willingness to pay extra/premium.

The findings clearly demonstrate that consumer awareness on energy efficiency is increasing (this is in comparison to BEE's estimate of awareness referred to earlier in this report) and also willingness to buy energy-efficient products is quite high. This willingness is, however, subject to addressing of certain issues, as expressed by consumers, by the concerned authorities, including government agencies.

Consumers have also shown their willingness to pay premium for energy-efficient products. However, this willingness is confined to a range of up to 10 percent, which is much below the price of energy-efficient products as compared to non-energy efficient products.

These all give a clear indication that the market of energy-efficient products is under evolution, but is emerging fast. The approach to how to make energy-efficient products more acceptable to consumers is discussed in Chapter 6.

Annexure 5.1: Region-wise Distribution of Sample Size (States and UTs)					
	States/UTs	Consumers (No.)		Traders (No.)	
		Planned	*Actual*	*Planned*	*Actual*
1	Assam	532	531	10	10
2	Bihar	1655	1663	11	11
3	Jharkhand	541	547	19	19
4	Orissa	736	737	18	18
5	West Bengal	1600	1611	25	25
	Total East	***5064***	***5089***	***83***	***83***
1	Chhatisgarh	415	426	12	12
2	Gujarat	1010	1016	52	50
3	Madhya Pradesh	1211	1212	28	26
4	Maharashtra	1931	1936	72	73
	Total West	***4567***	***4590***	***164***	***161***
1	Chandigarh	20	21	2	2
2	Delhi	275	274	20	20
3	Haryana	421	450	19	19
4	Himachal Pradesh	139	143	18	19
5	Punjab	485	485	28	28
6	Rajasthan	1131	1141	27	27
7	Uttarakhand	170	170	10	10
8	Uttar Pradesh	3320	3334	42	42
	Total North	***5961***	***6018***	***166***	***167***
1	Andhra Pradesh	1511	1525	44	44
2	Karnataka	1056	1070	31	31
3	Kerala	636	643	15	15
4	Tamil Nadu	1240	1211	48	48
5	Pondicherry	20	20	2	2
	Total South	***4463***	***4469***	***140***	***140***
	Region-wise Sample Distribution (in no.)				
	Region		***Consumers***	***Traders***	***Producers***
	East		5089	83	
	West		4590	161	
	North		6018	167	
	South		4469	140	
	Total		**20166**	**551**	**50**
	Total Sample Size				**20767**

Annexure 5.2: Type of Organisation and Need for Training to Promote Sales of EE Products (No.)				
		Yes	No	Total
Dealer	Frequency	1	3	4
Distributor/Retailer	Frequency	0	3	3
Distributor	Frequency	0	4	4
Franchisee	Frequency	2	2	4
Partnership	Frequency	21	12	33
Private Ltd.	Frequency	5	0	5
Proprietorship	Frequency	272	198	470
Retail chain	Frequency	1	0	1
Retailer	Frequency	6	20	26
Total	Frequency	308	243	551

Annexure 5.3: Type of Organisation and Need for Training (No.)				
		Store Type		
		Multi-brand Outlets	Executive Outlets	Total
Yes	Frequency	301	7	308
No	Frequency	233	10	243
Total	Frequency	534	17	551

Annexure 5.4: Type of Organisation and Formal Training Received for Promoting Sales of EE Products (No.)				
		Yes	No	Total
Dealer	Frequency	0	4	4
Distributor/Retailer	Frequency	0	3	3
Distributor	Frequency	0	4	4
Franchisee	Frequency	2	2	4
Partnership	Frequency	9	24	33
Pvt. Ltd.	Frequency	4	1	5
Proprietorship	Frequency	142	328	470
Retail chain	Frequency	1	0	1
Retailer	Frequency	3	23	26
Total	Frequency	162	389	551

Annexure 5.5: Type of Organisation and Formal Training Received for Sales of EE Products (No.)

		Store Type		
		Multi-brand Outlets	Executive Outlets	Total
Yes	Frequency	154	8	162
No	Frequency	380	9	389
Total	Frequency	534	17	551

Annexure 5.6: Type of Organisation and Sources of Training Received (No.)

		Industrial Association	NGOs	BEE	Others	Total
Franchisee	Frequency	1			1	2
Partnership	Frequency	3	1	1	4	9
Private Ltd.	Frequency	2		2		4
Proprietorship	Frequency	70	16	19	50	155
Retail chain	Frequency	1				1
Retailer	Frequency	1	1		1	3

Annexure 5.7: Type of Organisation and Sources of Training (No.)

		Multi-brand Outlets	Executive Outlets	Total
Industrial Association	Frequency	75	3	78
NGOs	Frequency	18		18
BEE	Frequency	21	1	22
Others	Frequency	53	4	57
Total	Frequency	70	16	86

Annexure 5.8: Type of Organisation and Personnel's Capacity to Explain to Customers Efficient and Inefficient Energy Products (No.)

		Yes	No	Total
Dealer	Frequency	4	0	4
Distributor/Retailer	Frequency	0	3	3
Distributor	Frequency	3	1	4
Franchisee	Frequency	3	1	4
Partnership	Frequency	22	11	33
Pvt. Ltd.	Frequency	5	0	5
Proprietorship	Frequency	380	90	470
Retail chain	Frequency	1	0	1
Retailer	Frequency	22	4	26
Total	Frequency	441	110	551

Annexure 5.9: Type of Organisation and Personnel's Capacity to Explain EE Products (No.)

		Store Type		
		Multi-brand Outlets	Executive Outlets	Total
Yes	Frequency	429	12	441
No	Frequency	105	5	110
Total	Frequency	534	17	551

Annexure 5.10: Traders' Perception of Season-wise and Product-wise Variations in Sales (No.)

Increase: Summer				
Appliances		**Multi-brand Outlets**	**Executive Outlets**	**Total**
Refrigerators	Frequency	379	15	394
Lights				
Bulbs/CFLs	Frequency	69	1	70
Tube lights	Frequency	50		50
Air Conditioners	Frequency	244	12	256
Geysers	Frequency	21		21
Fans	Frequency	225	5	230
TVs/LCDs	Frequency	181	5	186
Washing machines	Frequency	130	7	137
Microwave ovens	Frequency	59	2	61
Food processors	Frequency	37	1	38
Mixer-grinders	Frequency	151	1	152
Irons	Frequency	109	1	110
Water/irrig. pumps	Frequency	30		30
Dishwashers	Frequency	8	1	9
Others (coolers, computers, etc.)	Frequency	47	1	48

Annexure 5.11: Traders Perception of Season-wise and Product-wise Variations in Sales (No.)

Increase: Winters

Appliances		Multi-brand Outlets	Executive Outlets	Total
Refrigerators	Frequency	322	14	336
Lights				
Bulbs/CFLs	Frequency	37	2	39
Tube lights	Frequency	28		28
Air Conditioners	Frequency	233	12	245
Geysers	Frequency	18		18
Fans	Frequency	190	5	195
TVs/LCDs	Frequency	22	1	23
Washing machines	Frequency	54	3	57
Microwave ovens	Frequency	10		10
Food processors	Frequency	5		5
Mixer-grinders	Frequency	37	1	38
Irons	Frequency	37	1	38
Water/irrig. pumps	Frequency	23	1	24
Dishwashers	Frequency	1		1
Others...	Frequency	40	1	41

Annexure 5.12: Traders' Perception of Season-wise and Product-wise Variations in Sales (No.)

Increase: Rainy

Appliances		Multi-brand Outlets	Executive Outlets	Total
Refrigerators	Frequency	113	4	117
Lights				
Bulbs/CFLs	Frequency	36	-	36
Tube lights	Frequency	28	-	28
Air Conditioners	Frequency	78	2	80
Geysers	Frequency	28	-	28
Fans	Frequency	44	1	45
TVs/LCDs	Frequency	103	4	107
Washing machines	Frequency	51	3	54
Microwave ovens	Frequency	29	1	30
Food processors	Frequency	8	1	9
Mixer-grinders	Frequency	95	-	95
Irons	Frequency	49	-	49
Water/irrig. pumps	Frequency	19	-	19
Dishwashers	Frequency	1	-	1
Others...	Frequency	15	-	15

Annexure 5.13: Type of Ownership and Marketing Problems Facedin the Sale of Energy-efficient Items				
		Pvt. Ltd.	Sole Proprietorship	Total
Yes	Frequency	4	1	5
	%	10.0	10.0	10.0
No	Frequency	36	9	45
	%	90.0	90.0	90.0
Total	Frequency	40	10	50

Annexure 5.14: Type of Ownership and Type of Problems Faced in Marketing of EE Products (No.)				
		Pvt. Ltd.	Sole Proprietorship	Total
High upfront cost for consumers	Frequency	2	1	3
Retailer's lack of information regarding energy efficient appliances	Frequency	2	0	2
Total	Frequency	4	1	5

Annexure 5.15: Type of Organisation and Marketing Problems Faced in the Sales of EE Products (No.)						
		Organisation Type				
		Pvt. Ltd	Ltd	MNC	Other	Total
Yes	Frequency	1	3	0	1	5
No	Frequency	29	10	2	4	45
Total	Frequency	30	13	2	5	50

Annexure 5.16: Type of Organisation and Type of Problems Faced in Marketing of EE Products (No.)					
		Organisation Type			
		Pvt. Ltd	Ltd	Others	Total
High upfront cost for consumers	Frequency	0	2	1	3
Retailer's lack of information regarding energy efficient appliances	Frequency	1	1	0	2
Total	Frequency	1	3	1	5

Annexure 5.17: Type of Ownership and Perception of the Need for Broadening EE Product Range (No.)				
		Pvt. Ltd.	Sole Proprietorship	Total
Strongly agree	Frequency	12	4	16
Agree	Frequency	28	6	34
Total	Frequency	40	10	50

Annexure 5.18: Type of Ownership and Reasons Cited for Broadening of EE Product Range (MA)				
Reason		Pvt. Ltd.	Sole Proprietorship	Total
It will give more options to consumers	Frequency	13	4	17
	Column wise %	13	17	14
It will lead to more competition and hence decline in price	Frequency	30	7	37
	Column wise %	30	30	30
It will help in saving electricity	Frequency	36	9	45
	Column wise %	36	39	37
It will help in reducing pollution levels and saving environment	Frequency	21	3	24
	Column wise %	21	13	20
Total	Frequency	100	23	123

Annexure 5.19: Type of Organisation and the Need to Broaden EE Product Range						
Reason		Pvt. Ltd.	Ltd.	MNC	Others	Total
Strongly agree	Frequency	7	5	1	3	16
	Column Wise %	23	42	50	60	33
Agree	Frequency	24	7	1	2	34
	Column Wise %	77	58	50	40	69
Total	Frequency	31	12	2	5	49

Annexure 5.20: Type of Organisation and Reasons Cited for Broadening of EE Product Range (MA)						
Reason		**Pvt. Ltd.**	**Ltd.**	**MNC**	**Others**	**Total**
It will give more options to consumers	Frequency	9	5	1	2	17
	Column Wise %	12	14	25	20	14
It will lead to more competition and hence decline in price	Frequency	23	10	1	3	37
	Column Wise %	31	29	25	30	30
It will help in saving electricity	Frequency	26	13	1	5	45
	Column Wise %	35	37	25	50	37
It will help in reducing pollution levels and saving environment	Frequency	16	7	1	0	24
	Column Wise %	22	20	25	0	20
Total	Frequency	74	35	4	10	123

Annexure 5.21: Type of Ownership and Producers' Future Plan for EE Products				
		Pvt. Ltd.	**Sole Proprietorship**	**Total**
A complete shift to production of energy efficient products in the next 5 years	Frequency	5	0	5
	Column Wise %	12.5	.0	10.0
Production depends upon market situation	Frequency	30	9	39
	Column Wise %	75.0	90.0	78.0
Production depends upon government policies	Frequency	5	1	6
	Column Wise %	12.5	10.0	12.0
Total	Frequency	40	10	50

Chapter 6
Making Energy Efficient Products More Useful and Acceptable

The household sector, which is the focus of the present study, undoubtedly has a definitive role in energy efficiency. Electrical appliances constitute a major source of energy consumption in the household sector. Ensuring efficiency in these appliances can help reduce electricity consumption, on the one hand, and CO_2 emissions, on the other.

Studies indicate that the share of electrical appliances in household energy consumption is likely to increase significantly in future, because of growth in per capita income, increasing electrification and urbanisation. This will hold true for all households, but will be more so in higher-income urban and rural households.

This Chapter, drawing heavily from the preceding one (Chapter 5), sheds light on major issues of concern in India's drive towards ensuring energy efficiency in electrical appliances market, and also the way forward. This, however, is based on stakeholders' (consumers, traders and producers) perception.

Highlights from the Field Survey

The field survey conducted under the present study is unique, in the sense that it has not only gathered perception of over 20000 consumers and other stakeholders (traders and producers) but has also contributed to generating awareness about the need for energy efficiency and conservation. As the findings (as shown in previous chapter) reveal that a significant number of users of home appliances are not aware of energy efficiency, the survey has helped in creating awareness about energy efficiency among those consumers.

The inputs gathered from the field survey are from both those who are aware and those who are not aware. It covers consumers' and other stakeholders' perception of a large number of issues directly and indirectly related to energy use and also energy efficiency. While, on the one hand, the survey sheds lights on how consumers are using home appliances, on the other, it also indicates how scope for further penetration of energy-efficient products can be improved.

Some of the specific and more important inputs received from the field survey include: ownership trend; duration and use; trend in monthly electricity consumption; factors considered for purchase of appliances; consumers' awareness and their interests in knowing more on energy efficiency; sources of information; experience of traders on formal training for promoting sales of energy-efficient products; among others.

The survey findings, in a way, have, therefore, the potential to show a future path and course of action for various stakeholders currently involved in the drive for bringing in an era of energy efficiency in India. This future course of action can be premised on revealed strengths, limitations, opportunities and threats (or simply called SLOT) analysis emerging from the field survey. These are described in the following sections.

Box 6.1: Why Is Energy Efficiency So Critical for India?

The XII Five-year Plan, covering the period 2012-2017, emphasises the need for augmentation of the power sector's capacity. The goal is to add a total of 100,000 MW of capacity. Required investment needed to develop this generation infrastructure is estimated at nearly US$100bn.

There will be need for 43,600 MW of the coal/lignite component aggregate capacity of supercritical generating units. It is expected that 27 projects would be built, with a total of 64 units in the 660-800 MW range. Another 18 projects having 34 sub-critical units in the 500-600-MW range also would burn coal or lignite. Smaller sub-critical units would make up the balance of 76,500 MW.

With coal playing a very significant role in India's energy future, substantial investments will be required to boost the annual production of fuel to the required 900 million tonnes. Current thinking is that domestic sources would supply 845 million tonnes and the rest will come from imports.

In the distribution segment, required investment is estimated at US$86.4bn for the XII Plan. The infrastructure that must be installed to meet the Five-year plan is staggering:

- 2.5 million poles for 33-kV overhead lines,
- Another 9.4 million poles for other lines rated above 11 kV,
- 20 million poles for low-tension lines, and
- More than 50 million service connections need to be added.

The 33-kV lines planned total:

- 180,000 circuit kilometres,
- 11-kV lines 750,000 ckm, and
- low-tension lines 800,000 ckm.

Contd...

To put these numbers in perspective, India is planning to install, in five years, an amount of distribution cable that, if placed end to end, would circle the equator more than 40 times.

The 250,000 circuit breakers required (50,000 annually) nearly consume India's current production capability of 59,000 breakers and the 14 million meters required annually are well above the 12.5 million that the country could produce in 2009 (according to the Indian Electrical & Electronics Manufacturers Assn.) and the total requirement of 190,000 MVA in distribution-transformer capacity exceeds current annual production capacity by more than 3,000 MVA.

Source: Adapted from 2011 India Energy Handbook, International Energy Consulting Corporation.

This augmentation has to continue even beyond the XII Plan period, as India energy requirement is expected to further increase. This will require huge investments and can also raise environmental concerns. Promoting energy efficiency can, therefore, provide a certain way out to sustain growth and, at the same time, address environmental issues.

Strengths

The energy labelling programme appears to have made good progress, as reflected by the increasing usage of energy-efficient products and other developments. This is impressive, considering that it has happened in a very short span of time, as the programme was formally launched in 2006.

Some of the major developments, as reflected by data gathered through the field survey, and which are reflective of progress made by standards and labelling programme in India, are described hereunder.

Consumers now appear to have become more conscious about the need for energy efficiency and conservation. This growing consciousness is premised on increased awareness,

which is reflected by almost two-thirds of consumers who would either consider energy efficiency as a purchase criterion or are aware of energy-efficient products. What makes the development noteworthy is that another about one-third of consumers indicated their willingness to learn more about energy efficiency and conservation.

Consumer consciousness of energy efficiency and conservation is supported by growing consumer habit of switching off appliances when not in use. The habit of switching off appliances, though, may not necessarily be related to energy efficiency, as the present study does not have data to support this, but it is a fact that such a habit definitely contributes to energy savings. This habit may, however, be related to consumers being overburdened because of rising electricity bills.

Figure 6.1: Consumers' awareness about EE products (%)

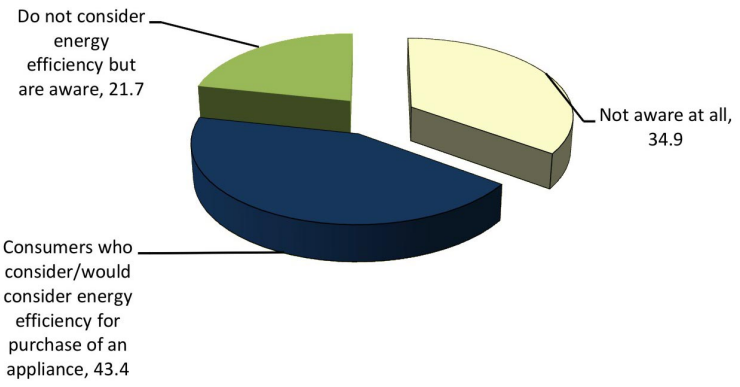
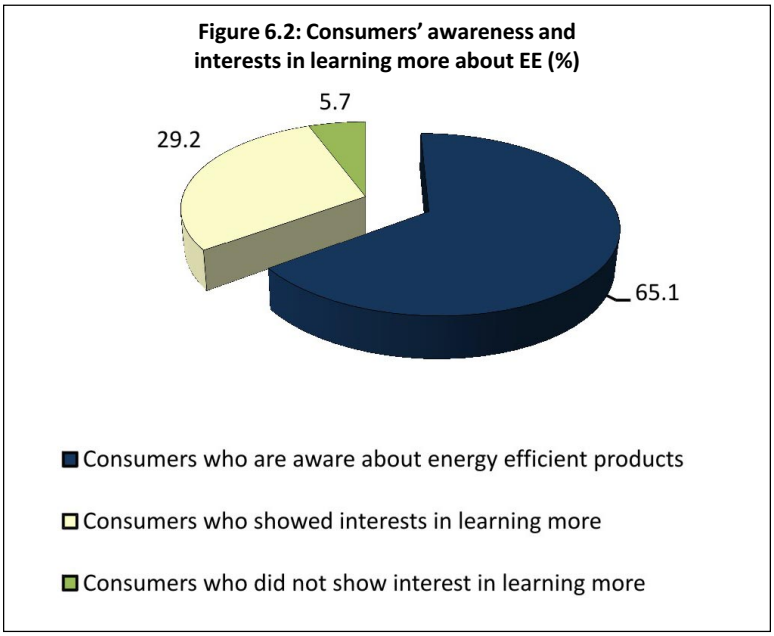


Figure 6.2: Consumers' awareness and interests in learning more about EE (%)



Increased penetration of television, which is also used as a source of information, appears to have significantly contributed to this. There are various other strengths which can be used for promoting an era of energy efficiency in India.

These include high level of satisfaction from the use of EE products (Figure 6.5); use of EE products leading to decline in electricity bills (Figure 6.6); consumers' perception of the need for marketing only EE products by traders (Figure 6.7); positive consumer plan to completely shift to EE products in future (Figure 6.8); and, most importantly, consumers' willingness to pay premium for EE products.

These positive developments at the demand-(consumer)-side are reinforced by producers agreeing on the need to formulate policies that promote EE products only (Figure 6.10).

Figure 6.3: Consumers' habit of switching off electronic appliances when not in use

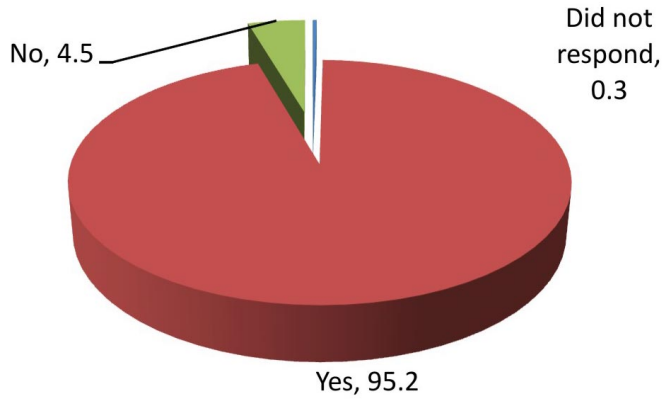


Figure 6.4: Major sources of how consumers identify EE products (%)

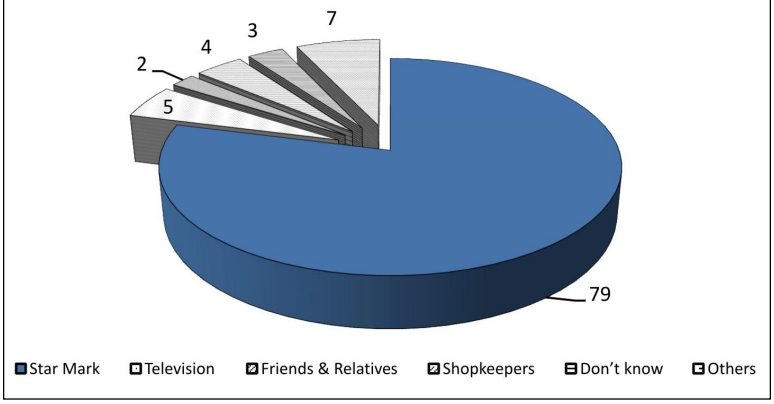


Figure 6.5: Satisfaction level among users of EE products (%)

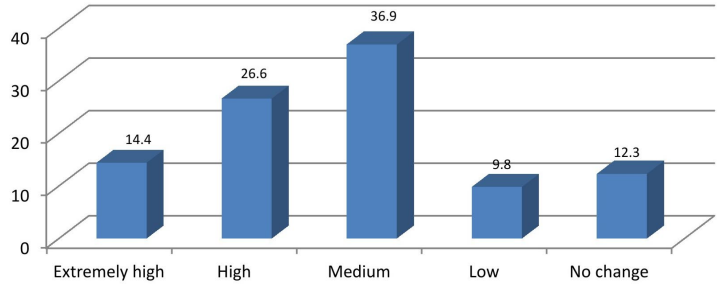


Figure 6.6: Whether use of EE products has led to decline in bills?

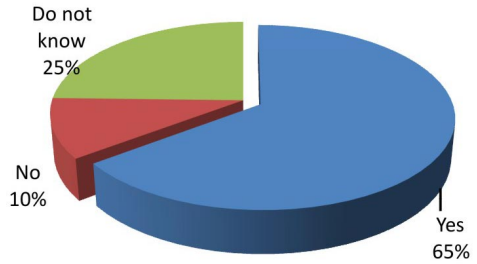


Figure 6.7: Need for marketing only EE products (consumers %)

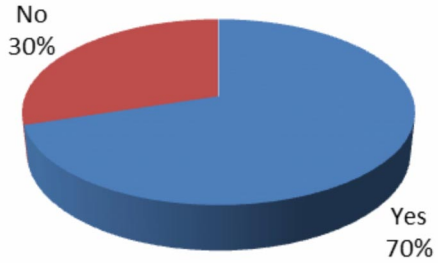


Figure 6.8: Consumers' plan to completely shift to EE products in future (%)

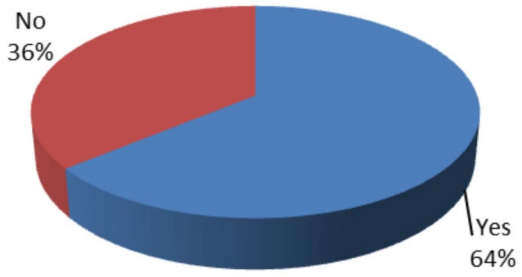


Figure 6.9: Reduction in electricity bill a major motivating factor consumers for shifting to EE products (%)

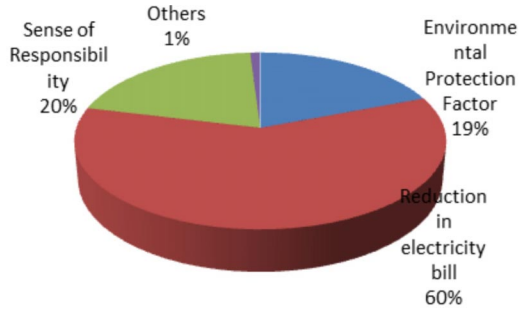


Figure 6.10: Need to formulate policies that promote EE products only (Producers%)

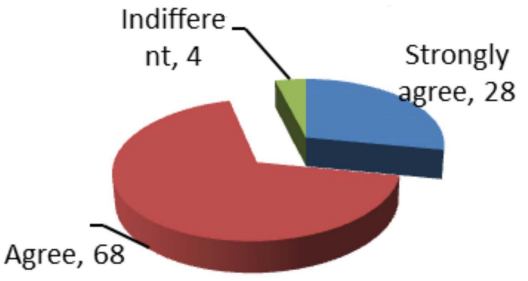


Figure 6.11: Reasons for broadening products' range (producers %)

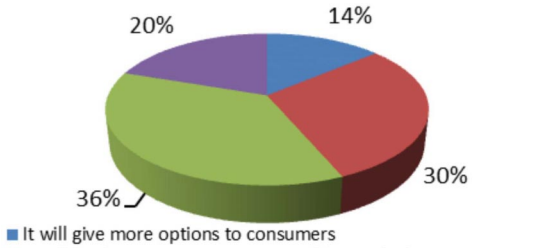


Figure 6.12: Producers' future plan on EE

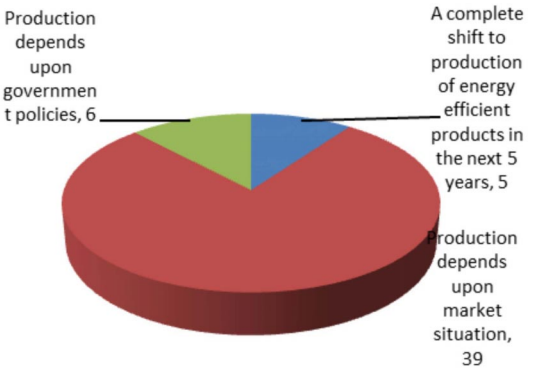
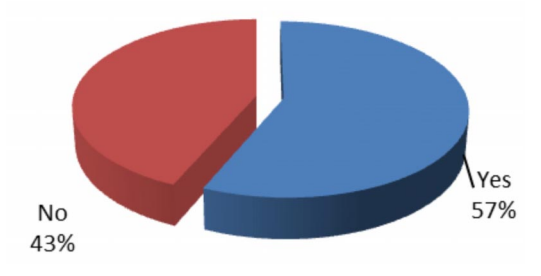


Figure 6.13: Consumers' willingness to pay premium for EE products (%)



The government agencies, especially the BEE, and other major players (traders and producers) should exploit this significant development with some more focused initiatives to further strengthen the developments that could lead to elimination of weaknesses and threats.

Box 6.2: Procedures Followed by BEE in Energy Labelling Programme

Under the BEE's labelling programme, manufacturers are empowered to test their appliances and affix labels based on the agreed categorical star-rating plan in the prescribed label format. BEE verifies the veracity of the labels and their levels through check-testing and challenge-testing in assigned NABL accredited laboratories. If the test results are not consistent with the declared star-rating on the label, BEE informs the concerned manufacturer. The manufacturer has an option to go in for a second verification testing. In this case, the sample size is twice the number of the first test and all the samples should pass the test.

If the appliance fails the second verification test, the manufacturer has the option to either correct the label level or remove defects or deficiencies found; or change particulars/information on the advertisement material and the label.

In addition to the check tests carried out by BEE, consumers, through consumer associations or any manufacturer or any person, can challenge the star-rating label. In this case, the BEE Implementation Committee looks into the history of verification test results. If the manufacturer fails to comply with the directions of BEE, then the use of the label for that model is prohibited and wide publicity about the failure can be made in the press. In addition, the manufacturer would be debarred from participating in public tenders.

Source: http://www.consumer-voice.org/energy-1.aspx, accessed on October 20, 2011

Limitations

- Consumer awareness, though showing an improvement, is yet to reach a critical mass, especially when it is examined in the context of income levels. Only 43 percent of people with income level below M10,000 are aware of EE products, thus leaving out 57 percent who are yet to know about energy efficiency and its associated benefits. Awareness level shows a progressive relationship with income levels – the higher the income, the higher the level of awareness. For the higher income group consumers, awareness varies in the range of 60 to 78 percent.

Box 6.3: Some Issues with Energy-efficient Products

Light from CFL is less than other types of bulbs. It is difficult to read in CFL light and, therefore, we shifted to tube lights.

S. Chatterjee, a consumer in Kolkata

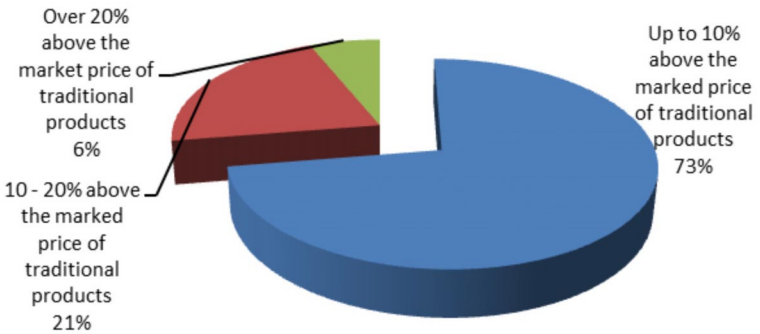
We wanted to buy a new refrigerator, but having discovered from our neighbours and others that new products do not work beyond warranty period, we postponed our plan. Our refrigerator is working well for last eight years, and we are happy with that.

Sheela Chakraborty, a consumer in Kolkata

- Considering that market price of EE products is significantly higher than that of traditional products, their demand can be adversely affected by the price. Data reveal that, out of the total consumers who are willing to pay premium for EE products, more than 70 percent of them showed their willingness to pay in the range of only up to 10 percent. Less than 10 percent consumers expressed their willingness to pay over 20 percent.

Another weakness of the emerging scenario is that the relationship between income level and willingness to pay does not give a clear direction. While willingness is found to be over 60 percent among consumers with income levels in the range of ₹10,000 to ₹75,000, this comes down to 55 percent in case of consumers with an income of over ₹75,000. This is indicative of the fact that creating willingness among these diverse income groups would require different approaches.

Figure 6.13: Distribution of consumers ased on their willingness to pay (%)



- More than 20 percent consumers are either not satisfied or not aware of the benefits from the use of EE products. Similarly, in the case of decline in electricity bills as a result of use of EE products, more than 35 percent consumers expressed that they are either not aware or have not realised any decline in electricity bills.

Major Challenges and Barriers to Energy Efficiency in India
• *Lack of baseline data* • *Low level of awareness* • *Huge unorganised market for a large number of appliances* • *Inadequate technical and manpower support* • *Need for a sustained media and/or other campaigns* • *Need for strengthening of nationwide testing capacity* • *Unaffordable price levels of EE products for a large section of consumers*

- There is not much post-sales interaction between traders and consumers. Nearly 64 percent of traders said that they do not receive any feedback from consumers once a product is purchased. It is also observed that even feedback received from the consumers is not fully communicated by traders to producers. In other words, the market suffers from lack of integration of the key players and can weaken the scope for product improvement and up-gradation.

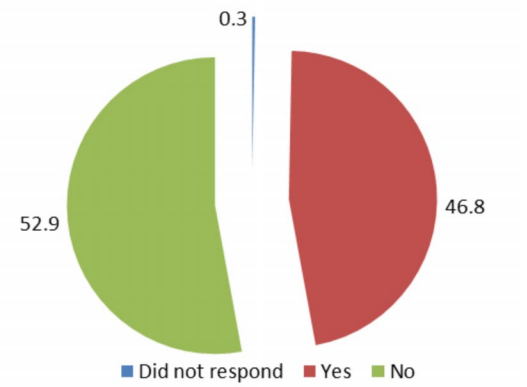
Opportunities

Two types of opportunities can be identified from the present scenario. One, opportunities emerging as a result of changing growth dynamics of the country – such as increase in per capita income level; rising level of awareness; improvement in level of education; and some others and the combined effect of these – leading to growing consciousness for energy conservation and greater acceptance for energy-efficient products. On the other hand, there are various challenges and barriers, as demonstrated by the survey, faced by consumers which can be converted into opportunities with

changes in policies and practices. While the first type will have a natural and automatic influence on the usage pattern, the second type of opportunities need interventions by policy makers and other stakeholders.

- Nearly 47 percent of consumers are overburdened by rising electricity bills (Figure 6.15). This might be because of increased use of appliances and rising tariffs. Programmes focusing on awareness generation and educating consumers about efficient and rationale use of appliances could help in improving the situation.

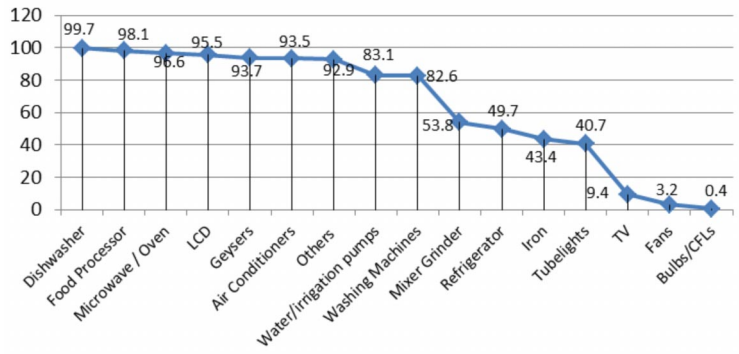
Figure 6.15: Consumers' perception on being overburdened by electricity bills (%)



- Data reveal that there is a large segment of population which does not own electrical home appliances (Figure 6.16). At least for 10 products, ownership is below the 50 percent mark. This implies that, product–wise, household electricity consumption could increase many fold if these consumers purchase and use these appliances. However, the consumption could be significantly lower if they buy EE products. This situation could be converted into an opportunity, by some focused initiative such as introducing a sustained awareness

campaign for consumers and traders, incentivising traders and facilitating wider dissemination of EE technology.

Figure 6.16: Consumers who do not own electrical appliances (%)



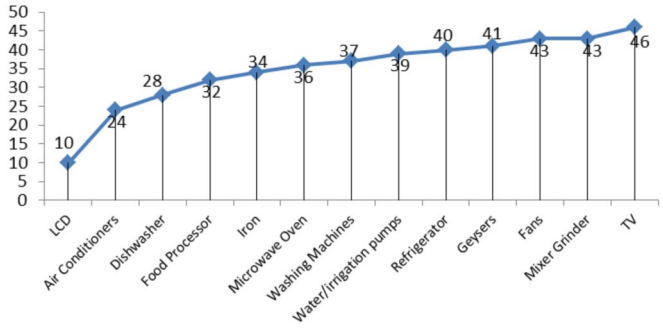
- A large number of consumers across all product groups are using appliances which are more than six years old (Figure 6.17 and 6.18). Going by the present rate of increase in per capita income and product up-gradation, one can expect that the market of electrical home appliances would explode in the next 8 to 10-year time period, as a huge number of products would be up for up-gradation or replacements. This could be a big number.

  Converting this upcoming demand into demand for energy-efficient products could be a huge challenge, but, at the same time, a big opportunity. Keeping this 10-year period in mind and also considering the opportunity, there is need for introduction of a multi-pronged strategy targeting consumers, traders and producers.

  While for consumers and traders a sustained campaign on awareness generation and education, supported by incentives (from producers and/or the government or

both), are required. For producers, there is need for incentivising energy-efficient technology acquisition and its wider dissemination. Government policy and support targeting these areas could be immensely useful and can lead to expansion of the market for energy-efficient products.

Figure 6.17: Percentage of Consumers using appliances for over 6 years (they might go for upgradation in the coming years)



- Market dynamics of energy-efficient products appears to have changed over the last two years. Data reveal that about 40 percent of energy-efficient products have been added in the last year alone. This is indicative of the emerging trend in EE product market and needs to be fully exploited.

Figure 6.18: Market dynamics of EE products

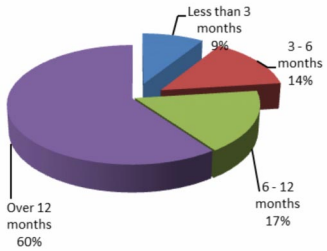
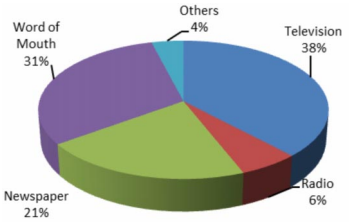


Figure 6.19: Television has become a major source of information for EE products

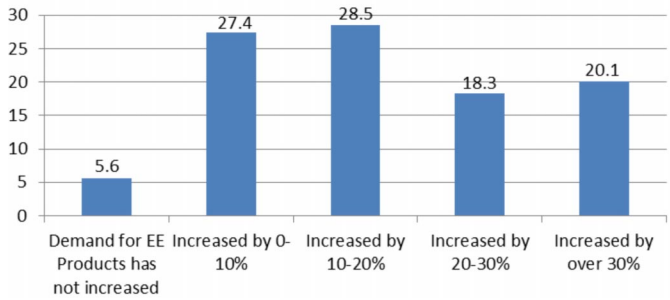


- There is a growing realisation among market players, such as traders and producers, that the demand for energy-efficient products is showing an increasing trend. Almost 95 percent of traders who were covered under this survey expressed this opinion (Figure 6.20).

  However, with respect to the level of increase in demand for energy-efficient products, a mixed response is found. More than 38 percent of traders opined that the demand for EE products has increased by more than 20 percent. For other group of traders constituting about 28 percent of the sample, the increase was in the range of 10-20 percent, compared to an equal number, saying that it was in the range of 0-10 percent.

  This variation in perception of sales of energy-efficient products may be because of location-wise and other (dis)advantages of some traders, compared to others.

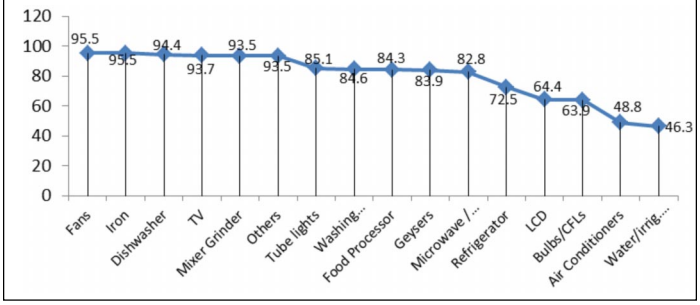
Figure 6.20: A majority of traders said demand for EE products has increased over the last two years (%)



Threats

- Despite the increasing level of awareness and high willingness expressed by a significant percentage of consumers, energy efficiency is a laggard and does not appear to be a major motivating factor for purchase of appliances. Product-wise data on motivating factors that

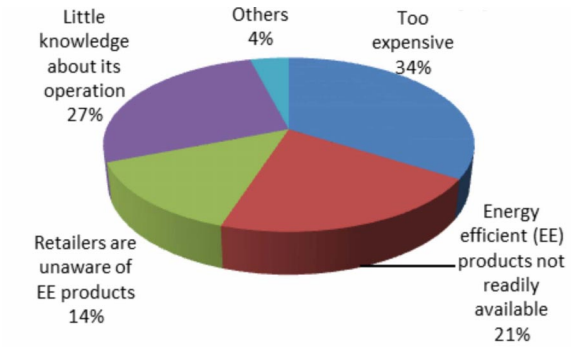
Figure 6.21: Percentage of consumers who are not motivated by EE while making purchase decisions



influence consumer demand for electrical/electronic appliances demonstrate that consumers give little weightage to energy efficiency. The weightage given varies from one product to another. It is observed and evidenced by the fact that, while in the case of electric fans, almost 96 percent of consumers do not consider energy efficiency as a motivating factor and, for water/ irrigation pumps, over 46 percent consumers think the same way.[43]

- Besides lack of awareness, the low weightage given by consumers to energy efficiency might be because of various other reasons. As indicated by the Figure 6.22,

Figure 6.22: Major problems faced by consumers in switching to EE products (%)



products being too expensive, along with little operational knowledge and inaccessibility, are the three major problems cited by consumers for the low weightage given to energy efficiency.

- The above revelation is reinforced by traders' perception of what consumers value most while making purchase decisions. Nearly one-third of traders are of the view that products' upfront cost is a major determinant which influences consumer purchase decisions. Similar observations can be made from the type of problems faced by producers. This can prove to be a real deterrent to energy efficiency drive.
- There are also some other issues which can prove to be real threats to the energy efficiency drive in India. Lack of training and lack of operational information among traders are two such critical bottlenecks, as revealed by traders.

Figure 6.23: Traders' perception on what consumers values most

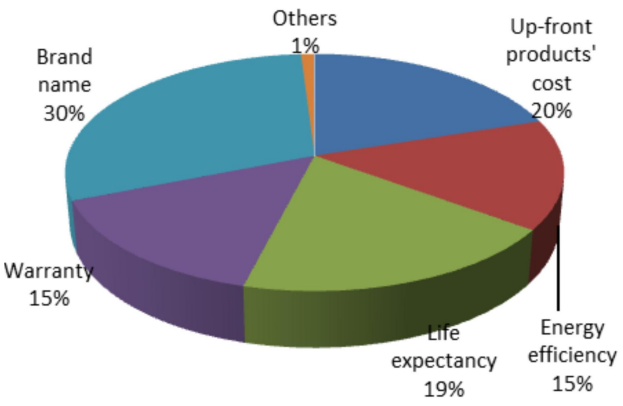
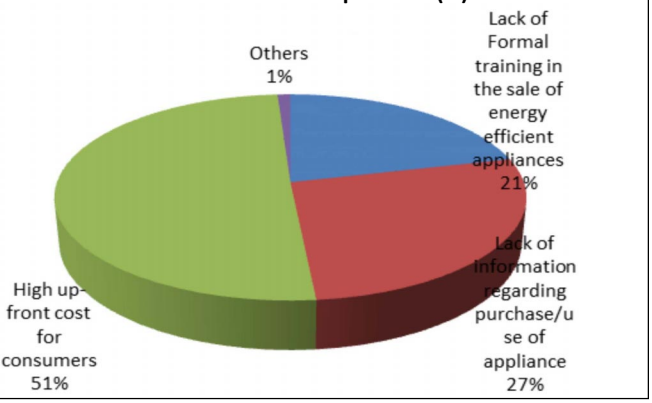
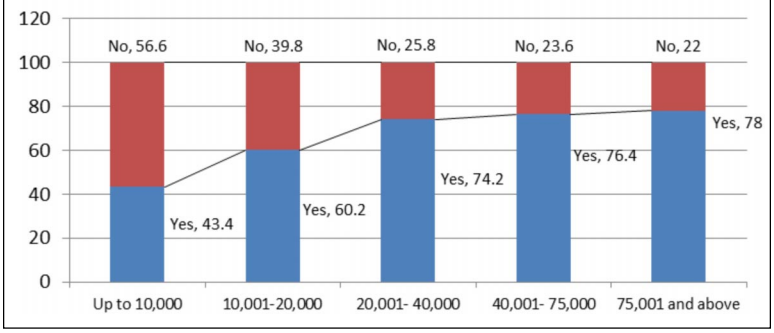


Figure 6.24: Types of problems faced by traders in sales of EE products (%)



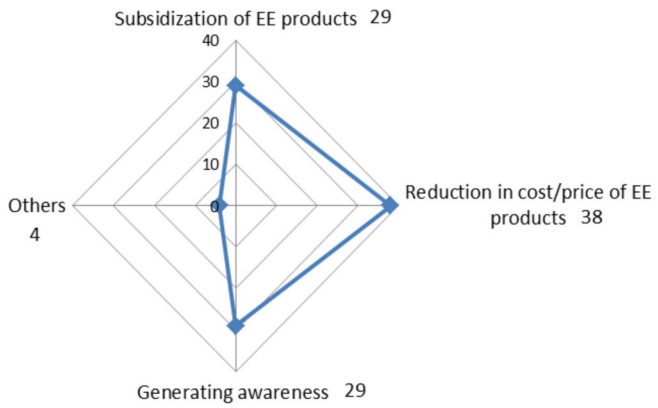
- Data clearly demonstrates that ownership of energy-efficient appliances is directly linked to income levels of consumers. A lower percentage of consumers with relatively low income own EE products. This might be, as indicated above, because of high upfront product costs. This calls for measures such as reduction in upfront cost (through sales tax exemption or other incentives to producers) and awareness generation to facilitate increased penetration of EE products among the low income groups.

Figure 6.25: Ownership of EE products varies with income levels (%)



- These threats could be overcome by three specific measures, as suggested by consumers themselves. More than two-third consumers are of the opinion that reduction in cost/price and/or subsidisation of EE products can significantly contribute to removal of these barriers. These initiatives, however, need to go hand in hand with initiatives for increasing awareness, feel nearly one-third consumers. The issue, however, looks very complex, as it requires active engagement and cooperation of various stakeholders.

Figure 6.26: Subsidisation/reduction in product cost can help remove barriers (%)



Some Empirical Evidence

Traders Estimation Equation

Based on data from the field survey on traders' income, the following empirical model was constructed to analyse the impact of knowledge of EE products on the traders' turnover.

$$Ln\,[AtEE] = \gamma_0 + \gamma_1 Years + \gamma_2 N + \gamma_3 S + \gamma_4 E + \gamma_5 GI + \gamma_6 KEE + \gamma_7 AEE + \omega \text{---- (1)}$$

Table 6.1: Summary Statistics

Variables	Mean	Standard Deviation	Minimum	Maximum
Log of total annual turnover from sale of Energy Efficient Products	13.84886	3.052229	-11.51293	17.87371
Years in Operation	14.06667	9.215473	1	56
North	0.392381	0.4887465	0	1
South	0.268571	0.4436392	0	1
East	0.110476	0.3137814	0	1
Received Governmental Incentives	0.352381	0.4781675	0	1
Knowledge on Energy Efficient Products	0.302857	0.4599322	0	1
Awareness on Energy Efficiency	0.794286	0.4046081	0	1

Table 6.2: OLS Estimates of the Effect of Traders' Knowledge about Energy Efficient (EE) Products on Annual Turnover from Sale of EE Products

Dependent Variable: (log of total annual turnover from sale of EE products)

Variables	Coefficients	Standard Errors
Constant	13.70	0.454
Years in Operation	0.024*	0.014
North (Dummy)	-0.102	0.350
South (Dummy)	-1.752***	0.388
East (Dummy)	-0.001	0.489
Received Governmental Incentives (Dummy)	0.431	0.277
Knowledge on Energy Efficient Products (Dummy)	0.477*	0.287
Awareness on Energy Efficiency (Dummy)	0.009	0.344
Number of Observations	525	
F-statistics (7, 517)	6.23	

*Note: * represents significance at 10 percent-level and *** represents significance at 1 percent level.*

Regression Analysis

The dependent variable in equation (1) is the natural log of annual turnover from sale of energy-efficient (EE) products. Here, the objective is to examine the relationship between traders' knowledge on energy-efficient products (KEE) and annual proceeds from sale of such products. Well, if the seller has the required knowledge on EE products, then he/she is efficient at promoting and selling such products effectively,

thus boosting revenues from sale of such products. Interestingly, the regression results show that if the seller possesses knowledge about EE products, then his/her annual proceeds from sale of such products increases by nearly 47 percent points.[44] And, the result is statistically significant at 10 percent level. Similarly, with the sellers' general level of awareness on energy efficiency (AEE), the annual turnover from sale of EE products increases by 0.9 percent points. However, this result is not statistically significant. And, the annual proceeds from sale of EE products increase by 2.4 percent points. This result is statistically significant at a 10-percent level.

Due to non-responses from many of the respondents on several variables, the sample size had to be reduced for the regression analysis. This, however, does not have any bearing on regression analysis. The reported values in the regression analysis are significant both economically and statistically.

On the result of regression analysis, one can argue that more knowledge on the part of traders does not necessarily imply that increased knowledge will incentivise traders, because of that revenue as marginal increase in revenue is likely to come at the expense of revenue from other appliance. While this holds true, it can also be argued that, with growing environmental awareness over time, consumers are willing to switch to EE appliances. Their preferences show sign of change, even though obstacles persist in the market such as the seller may be incapable of effectively marketing EE products. They may not be able to categorically define the advantages of EE products over non-EE products. Or, EE appliances may not be readily available in the market. But, if traders become more informed about EE products, their revenues from the sale of such products are most likely to increase. This is also demonstrated by the findings from the survey, which show that sellers' adequate knowledge on EE

products further enhances the sale of such products, thus boosting their revenues.

It is also unlikely that a shift to revenue from EE appliance sales will result in a decrease in absolute profit by traders. It is the consumer's interest that increases the trade volume of consumer goods. And, it is effective marketing and sales strategy, depending on trader's knowledge, which enhances sales of such products.

Consumers Estimation Equation

Similarly, based on data from the field survey on consumer preferences, the following empirical model was constructed

Table 6.3: Summary Statistics

Variables	Mean	Standard Deviation	Minimum	Maximum
Usage of Energy Efficient Products	0.46399	0.4987303	0	1
North	0.376553	0.4845492	0	1
South	0.398642	0.489647	0	1
West	0.072135	0.2587267	0	1
Urban Household	0.381155	0.4856985	0	1
Nuclear Family	0.661183	0.4733349	0	1
Obstacles Faced	0.559135	0.4965193	0	1

Table 6.4: Estimation of Consumers' Usage Pattern of Energy Efficient (EE) Products Using Logit Analysis

Dummy Dependent Variable: (usage of energy-efficient products)

Variables	Coefficients	Standard Errors
Constant	-7.340674	.5020771
Urban (Dummy)	1.131097 ***	.2715006
Nuclear (Dummy)	1.365835 ***	.3487768
Obstacles (Dummy)	1.444023 ***	.3420949
West (Dummy)	8.001407 ***	.4560648
Number of Observations	1954	
LR chi2 (4)	1886.51	
Prob > chi2	0.000	
Log likelihood =	234.54503	

*Note: * represents significance at 10 percent-level, ** represents significance at 5 percent level, and *** represents significance at 1 percent level. The logistic regression in STATA dropped North and South variables.*

to explain the factors that influence consumer demand for EE products.

$$U = \beta_0 + \beta_1 Urban + \beta_2 Nuclear + \beta_3 Obstacles + \beta_4 North + \beta_5 South + \beta_6 West + \epsilon \text{ ---(2)}$$

Regression Analysis

The dependent variable in equation (2) is a dichotomous variable that captures whether or not the consumer uses energy-efficient products. This variable will be explained by a set of explanatory variables such as type of family, rural/urban setting of the household and such other characteristics. *Obstacles* refer to whether or not the household faces problems in switching to *EE* products. Geographical variables are used in the model and East (*E*) is dropped to avoid perfect collinearity.

Interestingly, the logit regression results show that the log odds of using energy-efficient products increases by 1.131 for an urban household. The analysis shows that the log odds of using energy-efficient products increase by 1.365 for a nuclear family. And, with an admission to facing obstacles in switching to *EE* products, the log odds of using *EE* products by that particular household increases by 1.444. This shows households/consumers' willingness to use energy-efficient products, despite facing problems in switching to energy-efficient products.

The result obtained from the empirical model substantiates the study findings, as enumerated in strengths and opportunities of the SLOT analysis.

Towards a More Useful and Acceptable Approach

- The approach to making energy-efficient products more acceptable to consumer needs to be based on why and how consumers make their purchase decisions. A product is purchased because it serves to satisfy human needs. This satisfaction, however, comprises of many aspects

and may not be restricted to direct utilities derived from the product.

Studies demonstrate that purchase decisions by consumers are made based on their habits or, often, these are heavily influenced by an individual's emotions or the behaviour of others. At times, such decisions are made automatically. Progress made by countries in promotion of energy efficiency indicates that consumers rarely weigh-up the full costs and benefits of their purchasing decisions. "Instead, they are strongly influenced by emotional factors, the behaviour of other people, and by the use of mental short-cuts, which all help to speed up decision-making."[45] Policy must take into account all of these different factors, if it is to effectively influence consumer choice.

- From the field survey of consumers, traders and producers, three broad areas of concern emerge. These include low level of awareness, high upfront price of EE products and last, but not the least, the willingness to pay premium (Box 6.4). These three issues, if addressed effectively, seem to have the capacity to influence transformation of energy-efficient product market in India.

Box 6.4: Issues Emerging from the Field Survey

Issues related to awareness

- Purchase of EE products is critically dependent on level of awareness.
- Income levels appear to have direct influence on consumer awareness.
- The penetration of efficient products can be higher when consumers know about the label and relate domestic appliances to energy consumption, lower energy bills and wider issues such as climate change.
- Consumers are more likely to buy efficient appliances, if proper information is provided at point of sale.
- Awareness-raising campaigns need to be undertaken on a continuous basis.
- Consumers do not appear to equate appliances and their energy consumption to climate change issues.
- Consumers need to be educated and influenced to change their behaviour to give priority to other factors, besides upfront product price.
- Limitations in product range or low awareness do not provide enough choice to consumers.

Issues Related to Upfront Product Price

- High purchasing prices of EE products are a clear barrier to energy-efficient models.
- Consumers are less sensitive to efficiency issues, which keep them away from purchase energy-efficient products.
- Retailers appear to be more focused on sales rather than sales of sales of energy-efficient products and are influenced by consumers' low willingness to pay.
- Retailers need to be informed and trained on a regular basis, especially when new regulations/products are brought into the programme to influence consumer purchase decisions.

Contd...

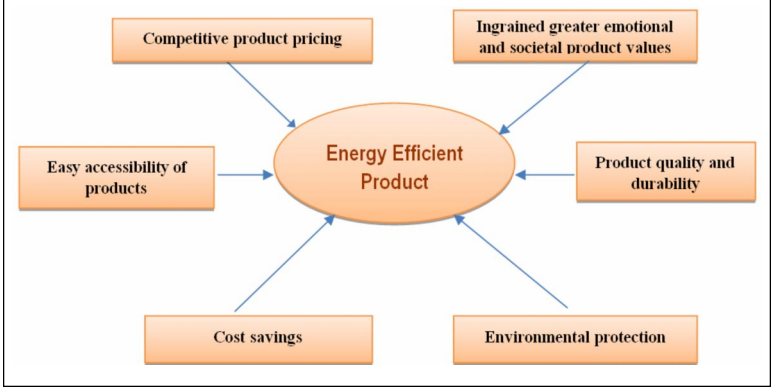
- Communication should be tailor-made to drive consumers away from the immediate short-term objective of going for low-priced inefficient products.

Issues Related to Willingness to Pay Premium

- Retailers analyse their customers' willingness to pay and from this develop the positioning of their various products. But, a low willingness to pay is also driven by developments in the market and society.
- Focus on purchase price has a negative impact on the willingness to pay. Consumers must be induced to focus on other criteria.
- The focus on purchase price can be for more than one reason and be linked to culture and habits: the willingness to pay more for trendy products, the culture of investing in cheap products, the traditional focus on lowest price criteria instead of quality/price ratio, etc.
- Consumers in low-income groups and those engaged in farming activities show lower willingness to pay.

- Emerging issues and concerns from the survey of consumers, traders and producers push product features at the centre stage. It is now obvious that products might not be successfully promoted based on the sole criterion of energy efficiency. These need to have features that motivate consumers, including but not limited to easy availability, competitive price, cultural and societal values and other features which consumers look for in a product. Energy efficiency can be just a component of products attributes (Box 6.5).

Box 6.5: Product Features That Could Facilitate Greater Acceptance of Energy-efficient Products



- Out of the six major product features (outlined in the box above), at least three – competitive product pricing, environmental protection and product quality and durability – are critically dependents on product technology and require proactive initiatives from stakeholders, including government agencies, producers and traders.

  Two features – easy availability and greater emotional and societal values – depend on product positioning in the market place. Cost saving, last but not the least important, can be attributed and related to saving electricity bills as a result of usage of EE products.

These product features must, however, be supported by effective policy measures consistent with the changing socio-economic conditions of consumers. Such policy measures can consist of both demand (consumers) and supply-side initiatives (traders and producers) to facilitate these stakeholders to work in a cohesive manner. While a sustained campaign to generate awareness and educating consumers about energy efficiency

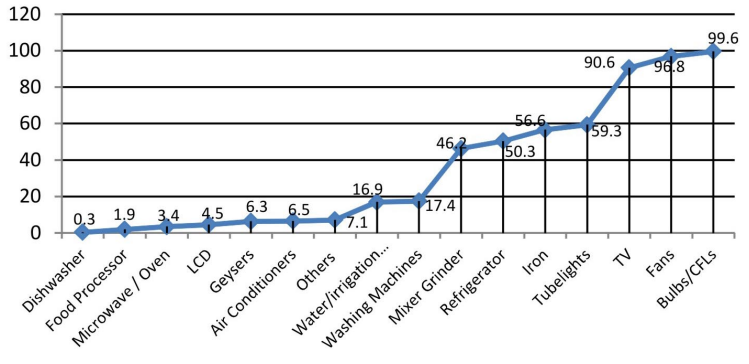
and conservation can be useful for creating a conducive environment, it will also require initiatives such as incentivising traders and producers for increased production and sales of energy-efficient products to concretise the process of transformation.

What Role Can CSOs Play in This?

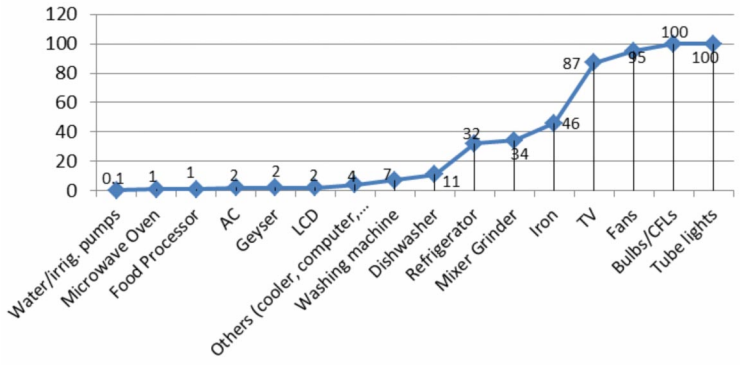
Supporting government/media campaigns that promote awareness:

- Enhancing people's participation in Energy Efficiency programmes;
- Extending coverage of programmes to areas/groups poorly served;
- Promoting training on energy efficiency; and
- Conducting advocacy work in partnership with the government.

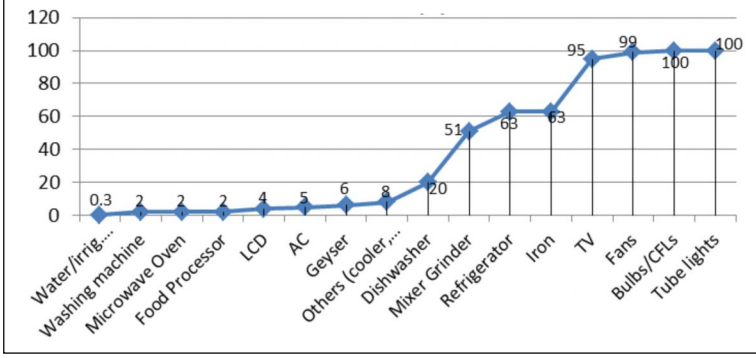
Annexure 6.1: Consumers' Ownership of Electrical Appliances (%)



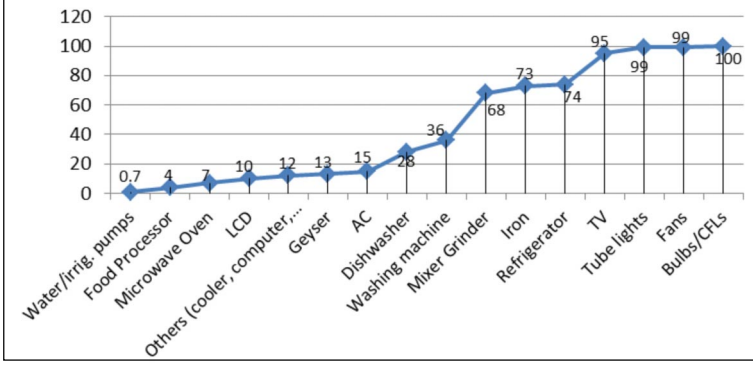
Annexure 6.2: Ownership of Electrical Appliances with Income Level of up to Rs 10K (%)



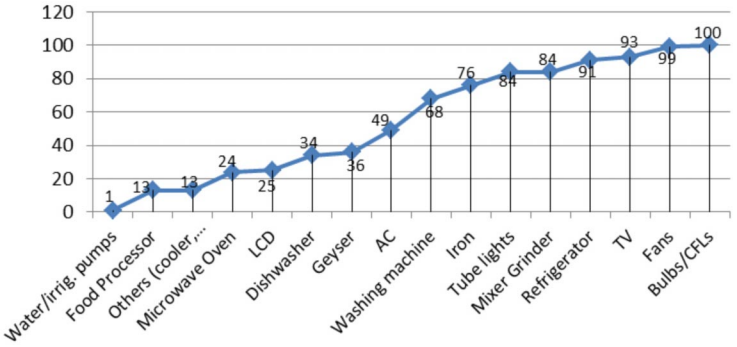
Annexure 6.3: Ownership of Electrical Appliances with Income Level of Rs10K to 20K (%)



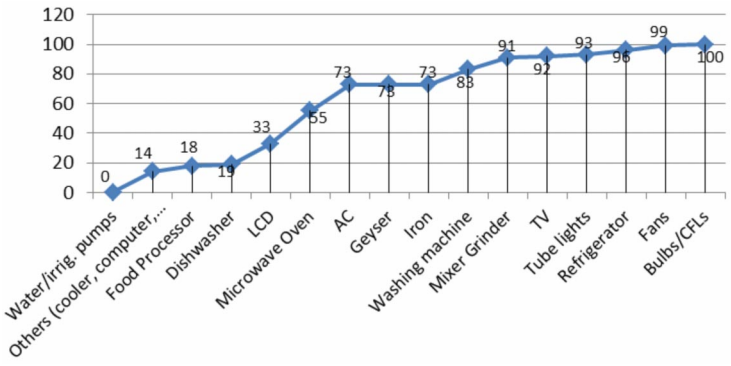
Annexure 6.4: Ownership of Electrical Appliances with Income Level of Rs20K to 40K (%)



Annexure 6.5: Ownership of Electrical Appliances with Income Level of Rs40K to 75K (%)



Annexure 6.6: Ownership of Electrical Appliances with Income Level of Rs75K (%)



Chapter 7
Conclusion and Recommendations Emerging from the Survey of Consumer Awareness on Energy Efficient Products in India

Conclusion

Energy Efficiency initiative is turning out to be a very useful tool for energy management in India. It has already made some progress and contributed in energy saving since its launch in 2006. To give an account of its contribution, total energy saving resulting from energy efficiency drive (as indicated in Chapter 3, Table 3.2) is indicated at 2172.6 megawatts. This saving has come from only eight products (air conditioners, direct cool refrigerators, frost-free refrigerators, fluorescent tube lights of 36 watts, colour televisions, ceiling fans, storage water heaters and agricultural pump sets).

Estimates show that this saving is as big as total electricity consumption of nearly 14000 households for one month, based on the average per household electricity consumption of 156 KW. Alternatively, this saving is equal to total electricity

consumption of 1160 households for one full year (for average household electricity consumption, see Chapter 5, Table 8).

What We Learnt about Consumers from the Field Survey?

- Consumers do not tend to weigh up all the costs and benefits while making purchase decisions;
- Consumers respond more to immediate losses than future gains;
- Consumers place a greater value on the immediate future and tend to discount future savings;
- Consumers are heavily influenced by other people; and

Energy saved so far is just the tip of an iceberg, considering its huge potential. A large number of consumers are yet to own electrical appliances and an even bigger number can be expected to migrate from non-energy efficient to efficient appliances in the coming periods. This argument gets strength from the fact that awareness and willingness to learn more about EE products among consumers are observed to be improving. In addition, consumers' willingness to pay premium for EE products has also improved. Based on these developments, one can expect that energy saving from the use of energy-efficient appliances will increase further with inclusion of more products and progress of the BEE's S&L programme.

The above potential could, however, be realised only when issues and concerns that have emerged from the survey are adequately addressed by the government, especially BEE. Three aspects appear to be critical for the success of energy efficiency drive. These include increased awareness, cost/price reduction and technology acquisition and dissemination. These need to be addressed simultaneously and, therefore, a long-term integrated strategy is the need of the hour. This implies drawing a plan for 10 years or longer periods, based on estimated energy demand and consumption and saving potential from the

household appliance segment. The plan should envisage specific roles for different stakeholders, devising plan of how state agencies (the nodal and inline ministries/departments) can act more cohesively and how private sector and CSOs can contribute in this.

The strategy should also focus on optimal use and exploitation of strengths to further enhance the opportunities. Limitations and threats to Energy Efficiency programme are also observed. Threats can come from willingness to pay low premium (a large number of consumers showed their willingness to pay premium in the range of up to 10 percent over and above the price of traditional non-efficient products), than what is required; low level of operational awareness on EE products among traders; existing market dynamics, which is more conducive for non-efficient products; and others. It needs to be ensured that influence of these on people and the market is substantially reduced to the extent possible.

Recommendations

Generating Awareness

- In India, while the BEE deals with energy efficiency, the Department of Consumer Affairs (DoCA), under the Ministry of Consumer Affairs, Food and Public Distribution, handles issues related to consumer welfare. These ministries/departments should work together and prepare an integrated plan for creating awareness on energy efficiency and conservation, especially relating to consumer awareness and education about energy efficiency. Consumer awareness campaign can be linked with DoCA's "*Jago Grahak Jago*" campaign.
- The BEE's campaign, such as the National Educational and Training Programme (NETP) initiated for 'Point of Sales Persons' of Channel Partners, should continue and extend the coverage.

- There is no short cut to awareness generation campaigns. It must continue for a longer period, rather it should continue till the option for buying energy *inefficient* products gets exhausted.
- Channels of creating awareness need to be appropriately worked out. Focus on one particular channel might not be effective. While for service and business class people television is the most important source of creating awareness (this also holds true for consumers in income bracket of over M10,000), for those engaged in farming activities, word of mouth is the best source.
- To bring rural consumers into energy efficiency arena and to create awareness among them, support from *panchayati institutions* should be secured through some policy initiatives. These institutions can be a useful tool in generating awareness among rural consumers.
- Trade outlets, being the exit point of both energy-efficient and alternative products, need to be educated and trained on a continuous basis to promote sales of EE products. They should also be educated on operational mechanism and product placements.
- There is a need to create an exclusive website for energy-efficient products at the national level, maintained and managed by the BEE or other agency authorised by it. The site should be a one-stop window for all the EE products and should give segment-wise comparative details of each product.

Neutralising Consumers' Price and Brand Considerations

- Consumers tend to give more weightage to models and prices than to product quality such as energy efficiency. Big brands in the market need to be advised to strictly follow and support government initiatives by focusing on energy efficiency requirements.

- Big brands should introduce and continuously run some incentive schemes for consumers such as prize/rebate on purchases of Energy Efficiency products. Funds for this prize should be created by major companies operating in the market place, with some fiscal support from the government.
- Technological innovation and adaptation is at the heart of reducing energy consumption. Government should facilitate technological innovation in product and processes through some incentives to producers. The incentive could be based on new innovation's energy saving potential over the product life cycle. A fund similar to the National Innovation Fund could be set up for the purpose.

  As far as adaptation of new energy-saving technology is technology is concerned, private sector private investors are unlikely to invest in technologies without government support. The government, or its agencies, should bear a part of the technology acquisition cost. Financing for this can come through the fund.
- The government should also facilitate wider dissemination of energy-efficient technologies among smaller players. For this, public sector organisations, especially those in research, such as the National Research Development Corporation (NRDC), have a bigger role to play. Their network could be used for developing energy-saving technologies and its wider dissemination.

Influencing Willingness to Pay

- Need for energy efficiency and conservation should be integrated with the educational system in India. School/college-going children should be educated to care more for energy efficiency. They should also be used to influence purchase decisions of their parents – paying higher price for energy-efficient products.

- Traders appear to have significant influence on consumers at the point of sales. Increasing traders' margin/income on sales of EE products can be a useful tool to enhance traders' interests in promoting sales of EE products. This can be achieved through devising a sales and energy-star-based incentive programme for traders. Traders could be entitled to an incentive equal to one year potential energy savings by the product. Financial support for this can come from the fund created by major companies operating in the market place, with support from the government.

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Questionnaires

Assessing Consumer Behaviour on Energy Efficient Products in India

date	Name of enumerator / supervisor
Interview	
	Enumerator's code
Checked	
Coding	
Checked	
Data entry	
Checked	

Introduction and Confidentiality

We request you to participate in a one-to-one interview on energy labeled (efficient) products in India. These primarily refer to existing products under BEE's S&L, and also those which are likely to come under S&L in future. This is part of a study that CUTS International is doing for assessing awareness and future inclination on energy efficient products in India. The interview will last not more than thirty minutes. Your participation in this research study is voluntary. At any time during the interview, you may ask questions for clarifications. We assure you that this information is purely for research and a strict confidentiality of information will be maintained

Note: The questionnaire has to be filled in the presence of family members.

I. General Information

Name of the Respondent			
Address (with telephone no.)	Telephone No:		
Village		*District*	
State			
Relationship with Household Head			
Type of Family	Nuclear: **1**		Joint: **2**
HH Income in INR per month	Up to 10,000: **1**; 10,001-20,000: **2** 20,001- 40,000: **3**; 40,001- 75,000: **4** 75,001 and above: **5**		
Class of Family	Above Poverty Line (APL): **1**; Below Poverty Line (BPL): **2**		
Category	Scheduled Caste (SC): **1**; Scheduled Tribe (ST): **2**; Other Backward Caste: **3**; General: **4**; Other: **5**		
Occupation	Service: **1**; Business: **2**; Farming: **3**; Others: (specify…….) **4**		

Code in the SEC grid based on above observations

Occupation	Illiterate	School Upto 4 yrs/ literate but no formal schooling	School 5-9 years	SSC/ HSC	Some College but not Graduate	Graduate/ Post Graduate -General	Graduate/ Post Graduate -Professional
Unskilled Workers	E2	E2	E1	D	D	D	D
Skilled Workers	E2	E1	D	C	C	B2	B2
Petty Traders	E2	D	D	C	C	B2	B2
Shop Owners	D	D	C	B2	B1	A2	A2
Businessmen/ Industrialist With employees:0	D	C	B2	B1	A2	A2	A1
1 to 9	C	B2	B2	B1	A2	A1	A1
10 +	B1	B1	A2	A2	A1	A1	A1
Self Employed Professionals	D	D	D	B2	B1	A2	A1
Clerical/ Salesmen	D	D	D	D	B2	B1	B1
Supervisory level	D	D	D	D	B2	B1	A2
Officers/ Executives - Junior	C	C	C	B2	B1	A2	A2
Officers/ Executives - Middle/Senior	B1	B1	B1	B1	A2	A1	A1

II. Energy Efficiency/Conservation

Q.2.1 Please tick appliances in your household that run on electricity & their year of purchase.

	Year of Purchase			
Appliances	**In last 1-2 years**	**In last 3-5 years**	**In last 6-8 years**	**Over 8 years**
Refrigerator				
Lights				
Bulbs/CFLs				
Tubelights				
Air Conditioners				
Geysers				
Fans				
TV				
LCDs				
Washing Machines				
Microwave/ Oven				
Food Processors				
Mixer Grinder				
Iron				
Water/irrig'n pumps				
Dishwasher				
Others…….				

Q.2.2 What is your average monthly electricity consumption?

Energy Sources	Energy Consumption (Units)	Energy Consumption Bill (INR)
Summer		
Winter		

Q.2.3 Have you ever felt that you were overburdened with the energy bills? ( )
(Yes: 1; No: 2)

Q.2.4 Do you and your family members switch off electronic appliances when not in use? ( )
(Yes: 1; No: 2)

Q.2.5 What factors you had considered or you would consider in the purchase of appliances listed below? Kindly tick appliances owned or planning to purchase.

	Factors Considered				
Appliances	**Brand**	**Model**	**Price**	**Marketing/Promotional offers**	**Energy Efficiency**
Refrigerator					
Lights					
Bulbs/CFLs					
Tubelights					
Air Conditioners					
Geysers					
Fans					
TV					
LCDs					
Washing Machines					
Microwave/ Oven					
Food Processors					
Mixer Grinder					
Iron					
Water/irrig'n pumps					
Dishwasher					
Others…….					

Q.2.6 If ticked energy efficiency for either of the appliances,
A. Then please tell us what it means to you?

_____
_____
_____

B. How do you identify an energy efficient appliance?

_____
_____
_____

Q.2.7 If not ticked energy efficiency for either of the products, then ask are you aware of energy efficient products? (Yes: 1; No: 2) ( )
IF CODED 1 in Q.2.7, GO TO Q.2.9, ELSE ASK Q.2.8

Q.2.8 Are you interested in learning about energy efficiency and conservation? ( )
(Yes: 1; No: 2)

Q.2.9 What is your source of information for energy efficient products? (MA)
Television: 1; Radio: 2;
Newspaper: 3; Word of Mouth: 4;
Others (specify……): 5

Q.2.10 Does your household have energy efficient appliances? ( )
(Yes: 1 No: 2)

Q.2.11 If you already possess energy efficient products, then how long have you been using these products? ( )
Less than 3 months: 1; 3-6 Months: 2;
6-12 months: 3; Over 12 months: 4

Q.2.12 If you have switched to energy efficient products, then what is your level of satisfaction with energy efficient products? ( )
Extremely High: 1; High: 2; Medium: 3;
Low: 4; No Change: 5

Q.2.13 Are you consuming less energy per annum with the use of energy efficient products?
Yes: 1; No: 2; Don't Know: 3 ( )

Q.2.14 If coded 1 in Q2.13, then what is your average annual percentage decline in electricity consumption? ( )
Up to 5 percent: 1; 5 – 10 percent: 2;
Over 10 percent: 3; No decline: 4

Q.2.15 If coded 2 in Q2.10 then ask do you have any problems in switching to energy efficient products?
(Yes: 1; No: 2) ( )

Q.2.16 If coded 1 in Q2.15 then please tick the problems faced in switching to energy efficient products from the following list. (MA) ( )
Too Expensive: 1;
Energy Efficient (EE) Products Not Readily Available in the market: 2;

Retailers are unaware of EE products: 3;
Little knowledge about its operation: 4
Other (Specify……): 5

Q.2.17 In your opinion, how can these barriers/hindrances be removed? (MA) ( )
Subsidization of Energy Efficient products: 1;
Reduction in cost prices of Energy Efficient products: 2;
Through generating Awareness about them: 3;
Other (Specify……): 4

Q.2.18 Do you feel that the retailers need to market only energy efficient products? ( )
Yes: 1; No: 2

Q.2.19 Do you plan to completely shift to all energy efficient products in future? ( )
Yes: 1 No: 2

Q.2.20 If coded 1 in Q2.19, then ask what motivates you to buy energy efficient products? (MA)
Environmental Protection Factor: 1;
Reduction in electricity bill: 2;
Sense of Responsibility: 3;
Other (Specify……): 4 ( )

Q.2.21 Would you like to pay more for energy efficient products?
(Yes: 1 No: 2) ( )

Q.2.22 If coded 1 in Q 2.21, then what premium would you like to pay for energy efficient products?
Up to 10 percent above the marked price of traditional products: 1;
10-20 percent above the marked price of traditional products: 2;
Over 20 percent: 3

Q.2.23 Do you consider cost factor for using your electrical appliances?
(Yes: 1; No: 2) ( )

Q.2.24 Please tell us something about your usage pattern.

Appliances	**Usage patterns** ***(Number of hours used per day)***		
	Summer	*Winter*	*Rainy*
Refrigerator			
Bulbs/CFLs			
Tubelights			
Air Conditioners			
Geysers			
Fans			
TVs			
LCDs			
Washing Machines			
Microwave Oven			
Food Processors			
Mixer Grinder			
Iron			
Water/irrg'npmps			
Others…….			

Thank you for your cooperation and time

Assessing Traders' Behaviour on Energy Efficient Products in India

date	Name of enumerator / supervisor
Interview	
	Enumerator's code
Checked	
Coding	
Checked	
Data entry	
Checked	

Introduction and Confidentiality

We request you to participate in a one-to-one interview on energy efficient products in India. These primarily refer to existing products under BEE's S&L, and also those which are likely to come under S&L in future. This is part of a study that CUTS International is doing for assessing awareness and future inclination on energy efficient products in India. The interview will last not more than thirty minutes. Your participation in this research study is voluntary. At any time during the interview, you may ask questions for clarifications. We assure you that this information is purely for research and a strict confidentiality of information will be maintained

I. General Information

Name of the respondent:	**Name of the store:**
Relationship to the Owner:	Type of the store: Multi-brand Outlets: **1** Executive Outlets: **2**
Types of Ownership:	Year(s) of Operation:
State / Province:	District:

II. Energy Efficiency/Conservation

Q 2.1 What kind of products do you sell? ( )
Electrical Products: 1; Non-electrical Products: 2; Both: 3

Q 2.2 Please tick appliances that you sell and answer their corresponding questions.

Appliances	Energy Efficient	Energy Inefficient	Annual Turnover (INR)	% Share of sales from Energy Efficient prodts.	% Share of sales from Energy In-efficient prodts.
Refrigerator					
Lights					
Bulbs/CFLs					
Tubelights					
Air Conditioners					
Geysers					
Fans					
TVs/ LCDs					
Washing Machines					
Microwave/ Oven					
Food Processors					
Mixer Grinder					
Iron					
Water/irrig'n pumps					
Dishwasher					
Others…….					

Q 2.3 Has demand for energy efficient products increased over the last two years? Yes: 1; No: 2 ( )

Q 2.4 If coded 1 in Q 2.3 then by what percentage has the demand increased? ( )
0-10 %: 1; 10-20%: 2; 20-30%: 3; Over 30%: 4

Q 2.5 Why has demand for energy efficient appliances increased? ( )
Increased Income: 1; Environmental Consciousness: 2;
Reduction in Electricity Bill: 3 Sense of Responsibility: 4;
Media: 5; Others (Specify……): 6

Q 2.6 If coded 2 in Q 2.3, then why has demand for energy efficient appliances decreased? ( )
Low level of Awareness: 1;
High Price of Energy Efficient Appliances: 2
Other (Specify……): 3

Q 2.7 Do you observe seasonal variations in sales of electrical appliances?
Yes: 1; No: 2 ( )

Q 2.8 If coded 2 in Q 2.7, please give some information on the seasonal sales patterns. (please v)

Appliances	Increase			Decrease		
	Summer	*Winter*	*Rainy*	*Summer*	*Winter*	*Rainy*
Refrigerator						
Lights						
Bulbs/CFLs						
Tubelights						
Air Conditioners						
Geysers						
Fans						
TVs/ LCDs						
Washing Machines						
Microwave/ Oven						
Food Processors						
Mixer/Grinder						
Iron						
Water/irrg'npmps						
Dishwasher						
Others…….						

Q 2.9 Do you require training to understand and promote the sale of energy efficient products? ( )
Yes: 1; No: 2

Q 2.10 Have you received any formal training for promoting the sale of energy efficient products? ( )
Yes: 1; No: 2

Q 2.11 If coded 1 in Q 2.8 then who provided the formal training? ( )
Industrial Association: 1; NGOs: 2;
Bureau of Energy Efficiency (BEE): 3;
Other (Specify……): 4

Q 2.12 Can you categorically explain to customers the differences between efficient and inefficient energy products?
Yes: 1; No: 2 ( )

Q 2.13 Have you received any feedbacks from consumers regarding satisfaction level of energy efficient products?
Yes: 1; No: 2 ( )

Q 2.14 If coded 1 in Q 2.11, then have you communicated those with producers?
Yes: 1; No: 2 ( )

Q 2.15 Have you received any incentives for selling energy efficient products?
Yes: 1; No: 2 ( )

Q 2.16 In your opinion, what do consumers value more when purchasing electrical appliances? ( )
Up-front Cost: 1; Efficiency: 2;
Life Expectancy: 3; Warranty: 4;
Brand name: 5 Other (Specify……): 6

Q 2.17 Do you face problems in the sale of energy efficient items?
Yes: 1; No: 2 ( )

Q 2.18 If coded 1 in Q 2.15, then please tick the problems faced from the following list. ( )
Lack of Formal Training in the sale of Energy Efficient Appliances: 1
Buyers' Lack of Information Regarding Purchase and Use of Appliances: 2
High Up-front Cost for Consumers: 3;
Other (Specify……): 4

Q 2.19 Do you have any suggestions for manufacturers on energy efficient products? ( )
Lowering the up-front cost: 1; Effective marketing of the products: 2 Other (Specify……): 3

Thank you for your cooperation and tim

Assessing Manufacturers' Behaviour on Energy Efficient Products in India

date	Name of enumerator / supervisor
Interview	
	Enumerator's code
Checked	
Coding	
Checked	
Data entry	
Checked	

Introduction and Confidentiality

We request you to participate in a one-to-one interview on energy efficient products in India. These primarily refer to existing products under BEE's S&L, and also those which are likely to come under S&L in future. This is part of a study that CUTS International is doing for assessing awareness and future inclination on energy efficient products in India. The interview will last not more than thirty minutes. Your participation in this research study is voluntary. At any time during the interview, you may ask questions for clarifications. We assure you that this information is purely for research and a strict confidentiality of information will be maintained

I. General Information

Name of the respondent:	**Organisation:**
Designation:	Year(s) of Operation:
Types of Ownership:	Type of organisation: Pvt.Ltd: **1**; Ltd: **2**; MNC sub.: **3**; Others (specify.....): **4**
State / Province:	District:

II. Energy Efficiency/Conservation

Q 2.1 Do you agree that there is a greater need not only to switch to production but rather broaden the range of choices of energy efficient products? ( )

Strongly Agree: 1; Agree: 2;
Indifferent: 3; Disagree: 4; Don't Know: 5

Q 2.2 Please tick appliances that are in production and answer their corresponding questions.

Q 2.3 Do you face any marketing problems either in the production or in the sale of energy efficient items?
Yes: 1; No: 2 ( )

Q 2.4 If coded 1 in Q 2.3, then please tick the problems faced from the following list. ( )
Lack of Technology: 1;
High Up-front Cost for Consumers: 2;
Buyers' Lack of Information Regarding Purchase and Use of Appliances: 3;
Retailers' Lack of Information Regarding Energy Efficient Appliances: 4;
High Cost of Production: 5;
Limited Market Penetra'n: 6;
Other (Specify……): 7

Q 2.5 Have you received any production related incentives from both the local- and national-level governments?
Yes: 1; No: 2 ( )

Q 2.6 If coded 1 in Q 2.5, then what types of incentives have you received so far? Please list them.

1……	6……..
2……..	7……
3…….....	8……..
4……	9……..
5……..	

Q 2.7 Do you agree that the government needs to formulate polices that promote production of only energy efficient products?
( )
Strongly Agree: 1; Agree: 2; Indifferent: 3;
Disagree: 4; Don't Know: 5

Q 2.8 What is your future plan for energy efficient products?

( )

A complete shift to production of energy efficient products in next 5 years: 1;
Production depends upon market situation: 2;
Prod'n depends upon govt. policies: 3; Other (Specify…): 4

Thank you for your cooperation and time

Endnotes

1 Due to some logistical issues, some of the smaller states/UTs could not be included. These include Arunachal Pradesh, Jammu and Kashmir, Meghalaya, Manipur, Mizoram, Nagaland, Tripura, Sikkim, Goa, Andaman and Nicobar, Lakshadweep, Dadra and Nagar Haveli, Daman and Diu.

2 There is no official distribution of districts. The distribution, therefore, is based on identifying districts as shown in the state map.

3 Composite Index is average of 13 indices including: percentage of population 0-6 years; birth order three and above; birth below 20; complete immunisation coverage; drop-out from full immunisation; female literacy rate; household using safe drinking water; household with toilet facility; percentage of electrified households; women receiving 2 TT injections; women receiving three or more ANC visits; under five mortality rate; and contraceptive prevalence rate. For details, see *Ranking and Mapping of Districts 2006, International Institute for Population Sciences*.

4 www.worldenergy.org/publications/energy_efficiency_policies_around_the_world_review_and_evaluation/1_introduction/1175.asp

5 See Centre for Sustainable Energy at http://energycenter.org/index.php/technical-assistance/Energy Efficiency/Energy Efficiency-definition

6 www.glassforeurope.com/en/issues/Energy Efficiency.php

7 www.clasponline.org/GB2ndEdition/Chapter2/Chapter2.htm

8 Assessment Report on Energy Efficiency: Institutional Arrangement in Asia, Economic and Social Commission for Asia and the Pacific, 2010.
9 Kala Namrata (2010), *Energy Efficiency in India: Overview and Future Outlook*, The Energy and Resource Institute.
10 Primary energy is defined as energy embodied in sources where human-induced extraction or capture, with or without separation from contiguous materials, cleaning or grading must be undertaken before energy can be traded, used, or transformed Source: http://unstats.un.org/unsd/envaccounting / londongroup/meeting13/LG13_12b.ppt#263,7,Proposed definition of primary energy, accessed on June 2, 2011
11 Statistical Review of World Energy 2010
12 Source: http://data.worldbank.org/indicator/ EG.USE.PCAP.KG.OE
13 Ryoichi Komiyama, *Energy Outlook to 2035 in Asia and its Pathways towards a Low Carbon Energy System*, The Institute of Energy Economics, Japan.
14 *Ibid.*
15 Stephen A. Holditch and Russell R. Chianelli, Factors That Will Influence Oil and Gas Supply and Demand in the 21st Century, Book review accessed on June 3, 2011. Source: http://www.wisecampus.com/uploads/ notescans/ Oil_and_Gas_Supply.pdf
16 *Op. cit.*
17 Annual Energy Outlook with Projections to 2035 (2011), US Energy Information Administration, http://www.eia.gov/ forecasts/aeo/pdf/0383(2011).pdf
18 Energy Outlook to 2035 in Asia and its Pathways Towards a Low Carbon Energy, The Institute of Energy Economics, Japan (IEEJ), 2010.
19 United Nations, Case Studies of Market Transformation, Energy Efficiency and Renewable Energy (2007) www.un.org/esa/sustdev/publications/energy_casestudies/ full_rpt.pdf
20 The Hundred Billion Dollar Bonus: Global Energy Efficiency Lessons from India, Climate Works Foundation, 2011.
21 www.gartner.com/it/page.jsp?id=1013212
22 Source: http://220.156.189.23/miscellaneous/documents/ rti_act/schemes_for_promoting_energy_ efficiency_

in_India_during_the_%20XI_Plan.pdf, *accessed on July 12, 2011*

23 *Alvin Jose TERI/BEE, Energy Efficiency Standards and Labelling in India, 2011* http://eneken.ieej.or.jp/data/3694.pdf accessed on July 16,2011

24 It is understood that since efficiency comes at a higher cost, sales may actually decrease with efficiency improvements.

25 The provider of end use equipment minimises the capital cost of the equipment, irrespective of the consequences of that decision on the energy consumer who has to pay for the operating costs.

26 *Source*: Asia Pacific Economic Cooperation, Mapping Exercise on Energy Efficiency Products - Reducing Trade Barriers for Environmental Goods and Services in APEC Economies, 2011.

27 United Nations, Trends in Consumption and Production, 1999.

28 Wei Xia, YinchuZeng, Consumer's attitudes and willingness-to-pay for Green food in Beijing, accessed on July 16, 2011 at http://sard.ruc.edu.cn/zengyinchu/files/taolunwengao/Consumer-s%20attitudes%20and%20willingness-to-pay%20for%20Green%20food%20in%20Beijing.pdf

29 www.nrel.gov/analysis/forum/docs/2004/french.ppt, accessed on July 15, 2011

30 Ward, David O. (2010), Consumers' Willingness to Pay for Energy Labels on Household Appliances, Master's Thesis, University of Tennessee.

31 Bogan, C.E. and English, M.J., 1994: Benchmarking for best practices: winning through innovative adaptation. McGraw-Hill, New York.

32 Nash, J. and Ehrenfeld, J., 1997: Codes of environmental management practice: assessing their potential as a tool for change. Annual Review of Energy and the Environment.

33 Source: Energy Efficiency Case Studies, 2010, http://www.nbi.org.za/Pages/Publication-Details.aspx?NBIweb=e586ac5b-bcad-49be-ba41-81b0f1fa2ba3&NBIlist=baaa9251-7130-4824-a0e9-0991a4bd678f&NBIitem=63

34 Source: www.un.org/esa/sustdev/publications/energy_casestudies/full_rpt.pdf

35 Source: http://africa-toolkit.reeep.org/modules/Module16.pdf

36 Source: Residential Appliance Rebate Programme, http://www.nysenate.gov/news/residential-appliance-rebate-programme

37 The rural coverage, as indicated by people engaged in farming in consumers' sample distribution by occupation, constitutes 21 percent of the total sample size. The remaining 79 percent consumers' sample can be considered as urban share.

38 The duration of product usage is indicative of the product last bought. It does not necessarily indicate first time use, as in the case of bulbs/CFLs.

39 The above trend is indicative of the fact that the market for electrical home appliances can be expected to explode in the coming period. This is especially because per capita income of people in India is increasing at a very rapid rate. It has doubled in the last five years (2005 to 2010), increasing from approximately M27,000 to over M54,000.

40 Average consumption of electricity has been worked out by aggregating the total consumption by all the surveyed households divided by the number of respondents.

41 This is a significant development, considering that a study in 2008 estimated that the total number of people aware of the BEE's labeled products is 36 percent in urban and 13 percent in rural areas.
Source: http://eneken.ieej.or.jp/data/3694.pdf

42 With efficiency improvements, there is a possibility of an adverse effect in the form of a 'rebound' – energy savings being off-set by a more intensive use of energy-efficient products.

43 The revelation made by ©Figure 6.20 appears slightly in contradiction to observations made in Chapter 5, which shows that about 55 percent consumers are using energy-efficient products. One possible answer for this could be that purchase of energy-efficient products is not solely determined by its energy efficiency features, rather it is simultaneously influenced by other factors such as brand, model, etc., which results in the present figure.

44 The given value is p-value as different from confidence interval. Confidence interval contains the true parameter

value and is usually of 90, 95 and 99 percent. A 99-percent confidence interval covers 99 percent of the normal density curve. As such, the analysis is not done to a ten-percent level. The reported ten percent is the p-value. A small p-value signifies that the findings are unlikely to have arisen merely by chance and so one rejects the null hypothesis that there is no difference between the two treatments. This signifies that there is a less than one in ten chance that a difference as big as that seen in the study could have arisen by chance, if there was really no true difference.

45 Designing policy to influence consumers: Consumer behaviour relating to the purchasing of environmentally preferable goods, Policy Studies Institute, accessed at http://ec.europa.eu/environment/enveco/pdf/RealWorldConsumerBehaviour.pdf

ISBN 978 81 8257 164 8

₹250/US$25

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