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RMA/IND-EMCAT-TR-28

Energy Management Consultation and Training Project (EMCAT): Demand-Side Management/Standards & Labeling

Trip Report

August 17 - September 2, 1997

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PREFACE

This report covers the trip made by Dr. Hameed Nezhad and Dr. Ashok Sarkar to India to complete tasks on the following components of the Energy Management Consultation and Training (EMCAT) project: (1) Demand Side Management (DSM) at the Ahmedabad Electricity Company, (2) DSM at Other Indian Electric Utilities, and (3) Energy Efficiency Standards and Labeling.

EMCAT is funded by the U.S. Agency for International Development (USAID), for which Resource Management Associates of Madison Inc. (RMA) serves as the prime contractor in implementing the project. The activities carried out by RMA under the first phase of EMCAT come to an end on September 13, 1997.

During the trip, Dr. Hameed Nezhad and Dr. Ashok Sarkar visited New Delhi, Ahmedabad, and Chennai. The dates of their trips were from August 17 to August 30, and from August 15 to September 2, respectively. Several meetings were held with the new USAID contractor for EMCAT, International Resources Group (IRG), in order to provide information on the first phase findings of RMA and to enable a smooth transition to the second phase. Under the task related to DSM at Other Indian Electric Utilities, Dr. Hameed Nezhad provided technical assistance in the area of DSM at the Tamil Nadu Electricity Board (TNEB) in Chennai.

Several meetings were held with officials from various departments of TNEB, and DSM program options were evaluated using the DECIDE model. Dr. Sarkar also assisted in this activity. For the Standards and Labeling work, interactions with Bureau of Indian Standards (BIS), Energy Management Center (EMC), and Consumer Education and Research Center (CERC), and product committee representatives took place, in which the recent changes related to introduction of labeling for some appliances were reviewed and activities in area of strengthening standards for energy efficiency were discussed. Dr. Sarkar provided assistance to CERC on life-cycle costing issues related to energy efficiency analysis of residential appliances. Dr. Sarkar helped organize the AEC-RMA-USAID DSM Conference held in Ahmedabad, and he presented a paper on energy efficiency standards and labeling at that conference. Dr. Nezhad helped Ahmedabad Electricity Company (AEC) develop the program for, and organize, the AEC-RMA-USAID DSM Conference. He presented a paper on the DSM Experience in the United States. Dr. Nezhad also moderated a panel discussion session on future DSM implementation strategies in India at this conference.

This is a working document published informally by RMA in a working document format to present the activities of the trip in a timely manner. It has thus received only light review.

1. ENERGY EFFICIENCY STANDARDS, LABELING, AND TESTING

EMCAT Tasks and Activities

The energy efficiency standards and labeling component was conceived and implemented under the EMCAT first-phase extension in March 1997. With the first trip in March-April, an initiative was launched to develop and strengthen standards for electrical appliances and introduce the concept of labeling for energy efficiency of selected appliances for the household sector, initially with a voluntary system of labeling. RMA has worked with Bureau of Indian Standards (BIS), Energy Management Center (EMC), and Consumer Education and Research Center (CERC) on assessing existing standards, defining program design and implementation plans for strengthening standards, providing directions toward the introduction of a system of voluntary labeling, identifying a list of appliances on which to focus, and evaluating testing facilities and requirements. Information on global standards and labeling and RMA's assessment of the status in India has been disseminated through reports and a workshop session on standards and labeling at a conference organized by AEC and RMA on August 29 in Ahmedabad. This trip report covers the second trip conducted under the activities of this newly added component of EMCAT.

The future tasks in this important area will be carried out by USAID's new contractor, International Resource Group. RMA staff has been interacting on a regular basis for the past two months with IRG, and continued to do so during their trip to India.

Key Meetings and Discussions

During this trip, specific discussions were held with the following organizations and their staff members involved with energy efficiency standards, labeling, and testing activities in India:

- Consumer Education and Research Center (CERC) in Ahmedabad (officers met: Mr. L.S. Sharma, Mr. Abhinava Shukla)
- Bureau of Indian Standards (BIS) in New Delhi (officers met: Mr. P.S. Das, Mr. B. Mukherji, Mr. A.K. Sen, Mr. K.B. Gupta, Mr. R.C. Jain)
- Energy Management Center (EMC) in New Delhi (officer met: Mr. Satish Sabharwal)
- Fedders Lloyd Corporation Limited (appliance manufacturer) in New Delhi (officer met: Mr. Bhupinder Godara)

In addition, several informal discussions were held with staff members of other energy-related agencies that were present at the AEC-RMA-USAID DSM Conference in Ahmedabad. The business cards of people whom Dr. Sarkar and Dr. Nezhad met during the trip are given in Appendix I. During these meetings, inputs were gathered to obtain an update on the present status of standards, assess the initiatives by the government and other agencies in strengthening the standards, and discuss the potential of forthcoming voluntary labeling initiatives (see following sections) in the area of energy efficiency of refrigerators, air conditioners, and water heaters (geysers). Manufacturers' perspectives on energy efficiency issues were obtained in one of the meetings. The process of setting standards within BIS and the system of voluntary labeling, to be introduced soon, were critically examined by RMA, and suggestions were provided at these meetings as well as at the presentation at the AEC-RMA-USAID DSM Conference in Ahmedabad.

Assistance was provided to CERC on life-cycle costing issues related to energy efficiency analysis of residential appliances. Appendix II provides sample life-cycle costing calculations for refrigerators and air-conditioners. A spreadsheet-based, simple life-cycle costing software was also provided to CERC.

Update of Energy Efficiency Standards and Labeling Initiatives in India

As a follow up to the workshop on energy efficiency standards and labeling held in March 1997 (refer RMA/IND-EMCAT-TR-26), a major step for institutionalizing voluntary energy labels for refrigerators, air-conditioners, and storage water heaters were taken in BIS in June-July. The proposed BIS amendments are IS1476 (for refrigerators), IS1391 (for room air-conditioners), and IS2082 (for storage water heaters). Appendix III gives these details.

Unlike "market pull"-based, consumer-driven energy efficiency labeling in the U.S., Japan, and industrializing countries like the Philippines and Thailand, the proposed labeling system in India would be a manufacturer-driven "market push" activity. It is expected that manufacturers of energy-efficient equipment would start using the labels first, and that will create customer demand. This, in turn, would induce manufacturers of less efficient equipment to produce better products in order to keep their market share and maintain their competitiveness. Therefore, in the long-run, the appliance stock available in the market would become more efficient on a continuous basis.

Recommendations and Future Prospects

There is enormous energy efficiency potential in India, and standards and labeling are a class of energy policy that can go a long way in tapping this potential. The issues of what type of label would be most effective in influencing customer decisions needs to be studied further before this labeling system is instituted. The selection of the type of labels to be used for the three appliances mentioned above was done quite arbitrarily, and it is difficult to say if they would truly influence consumer buying behavior. The study done by Kirloskar Consultants had found that efficiency was at the bottom and price was at the top of the priority list of factors that are used in purchasing decision-making. Hence, the proposed label, that does not give any cost information but only provides technical information, may not be very effective.

It was also felt that, in the long run, energy efficiency standards and labeling would have to be made mandatory in order to create the market pull for energy-efficient products. EMC and CERC are of the opinion that some kind of mandatory system needs to be introduced. BIS feels that it will take time to mandate such a system as it has to be actually legislated in the Parliament and that, so as to not lose ground waiting for the legislation, a voluntary system is appropriate at the moment. Also, there is concern regarding the institutional structure existing in India at the moment and how that will be able to cope with the requirements of certifying energy efficiency labels if they are made mandatory.

Nevertheless, consumer awareness regarding energy efficiency needs to be increased before expecting any occurrence of market pull for better products. On the government front, the forthcoming system of regulation in the electric power sector should incorporate the use of energy efficiency and rationalize the electric tariffs that consumers pay to make this activity self-

sustainable. Furthermore, there is a need for continuous up-gradation of the standards in order to reflect the improvement of products available in the market. The Energy (Conservation) Bill, which seeks to make energy audits and energy efficiency labeling compulsory for industry, has been finalized by the Union Power Ministry and sent to the Cabinet for approval.

Information Dissemination

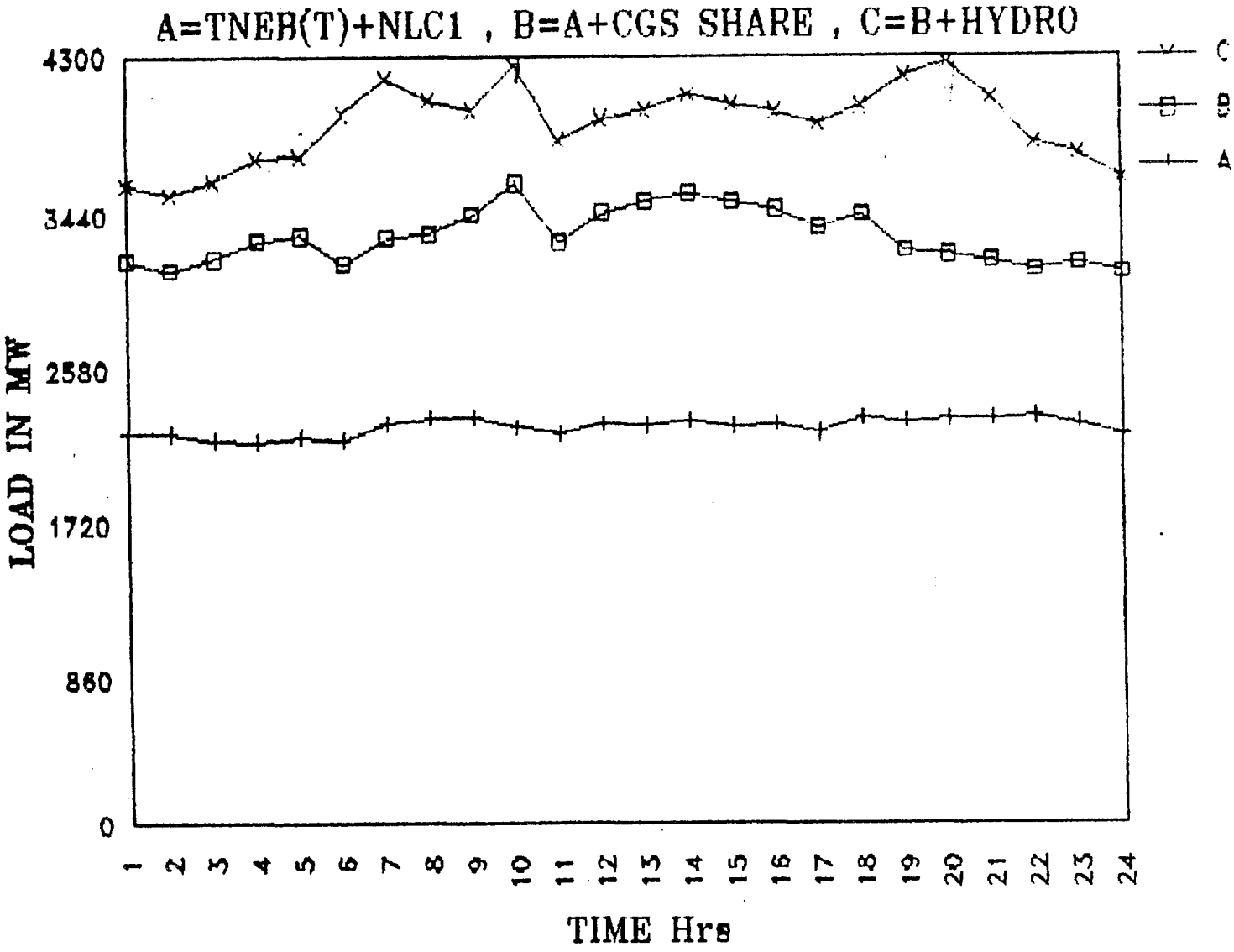
A paper on the status of the energy efficiency standards and labeling initiative in India was presented at the AEC-RMA-USAID DSM Conference on August 29 in Ahmedabad. The paper, titled "Energy Efficiency Standards and Labeling Initiative in India: An Evaluation of Status, Barriers, and Potential," and presentation slides are attached in Appendix IV. A similar version of this paper will also be presented at the Twentieth World Energy Engineering Congress of the Association of Energy Engineers in Atlanta, USA, in November 1997.

2. DSM PROGRAM DESIGN AT TAMIL NADU ELECTRICITY BOARD (TNEB)

Background Information on TNEB

TNEB is a state-owned utility with more than 10 million customers. There are about 6.5 million residential and 1.5 million agricultural customers. The rest are industrial, commercial, and municipal consumers. However, in 1996, the industrial sector accounted for about 40% of total electricity consumption, followed by agricultural sector (27%), residential sector (17%), and commercial sector (7%). Municipal and other customers accounted for the rest. The average cost of power supply in 1996 was 2.28 Rupees/kWh, and average sales were about 1.95 Rupees/kWh, resulting in a loss of 0.33 Rupees per kWh. This is largely due to the provision of free power to 1.5 million agricultural consumers. According to TNEB officials, the Government compensates TNEB for part of this subsidy by paying TNEB about 3 billion Rupees annually. *Figure 1* shows TNEB's load curve.

Figure 1: TNEB's Load Curve



Key Meetings and Discussions

After meeting with Senior Engineers in distribution, planning, and finance, a meeting was held at the R&D department to discuss DSM opportunities at TNEB. The following is a summary of our discussions:

- Since TNEB is a public utility, it is obligated to provide free power to the agricultural sector and, at subsidized rates, to low-income residential sector. Since electricity demand by these sectors is increasing, targeted load shape objectives for both of these sectors are strategic load growth and strategic conservation. In the agricultural sector, load shifting is also considered as a desirable strategy. A proposal for direct control of agricultural pumps is currently being considered.

- Because of the larger share of the industrial sector, DSM implementation in this sector would make a major impact on total system load. Strategic load growth and peak clipping would be effective strategies in this sector. With provisions in the new tariff structure, valley filling is being promoted in the industrial sector (see the following section and Appendix V for more details on the new tariff structure).

- The major loads in the residential sector are lighting, cooling (mainly fans), water heating, and appliances, and these loads are increasing. Direct installation of energy-efficient lighting systems would help reduce this load during peak hours. Also, introduction of energy efficiency standards and labeling of air conditioners and appliances would promote use of energy-efficient products.

Table 1: TNEB's Customer Categories

Sectors	Connected Load (MW)	Connected Load (Percent of Total)	Energy Use (Percent of Total)
Residential	5,233	28.2	16.86
Commercial	1,020	5.5	6.62
Public Lighting	69	0.4	*
Public Water Works	200	1.1	*
Agriculture	5,263	28.4	26.93
HT Supply	3,645	20.0	*
Industrial	2,840	15.3	39.95
Others	255	1.4	9.64
Total	**18,525**	**100**	**100**

*Note: In the last column, commercial includes public facilities and industrial includes HT supply.

TNEB's Tariff Structure

A detailed description of TNEB's tariff structure is provided in Appendix V. *Table 2* below presents the weighted average of TNEB's revenues per unit sold to different customer groups:

Table 2: TNEB's Revenues Per Unit Sold to Different Customer Groups

Tariff Categories	Energy Charge Rs/kWh	Demand Charge Rs/kVA per month
HT (I)	2.85	125
HT (II)	2.15	100
HT (III)	2.96	150
HT (IV) Lift Irrigation	0.25	0
LT (I)	1.39	0
LT (II)	2.45	0
LT (IIIA)	1.93	0
LT (IIIB) Institutional	3.00	125
LT (IV) Agriculture	0	0
LT (V)Commercial	3.5	0
Public Lighting and Water Supply	1.67	0

Note: HT industrial customers are on the "Time of the Day" (TOD) tariff. TOD rates relate to Energy Charge only, Demand Charge being payable as usual. Energy charges are 20% higher during the peak hours of 6:00 a.m. to 9:00 a.m. and 6:00 p.m. to 9:00 p.m. Also, all industries operating night shifts only (9:30 p.m. to 5:30 a.m.) are given 40% concession of the appropriate tariff for a period of seven months, from July to January, for five years.

DSM Program Design at TNEB: A Qualitative Analysis

A team of five staff members from the R&D department of TNEB and two RMA staff selected two sectors (Residential and HT Industrial sectors) for this analysis. Using DECIDE® software, the team conducted the following analysis:

- TNEB's load shape objectives for each sector were identified and prioritized.
- Major end-uses in each sector were identified and prioritized, based on their contribution to each load shape objective.
- DSM implementation strategies for each end-use were identified and prioritized

The following is a summary of findings:

A. Residential Sector

There are more than six million residential customers in TNEB's service territory, most of whom consume less than 300 kWh per month. Since the average tariff rate for this group is less than TNEB's long-run marginal cost, this group is subsidized by TNEB and would, therefore, be an ideal target for DSM.

Load Shape Objective in Residential Sector

Load shape objective	Priority Weight
Strategic Load Growth	30%
Strategic Conservation	70%

Since the residential load is high and growing, strategic conservation (improving energy efficiency of electricity using products such as lighting, cooling, water pumps, and appliances) is given a higher priority.

End-Uses in Residential Sector

The residential end-uses that contribute the most to TNEB's peak load are primarily lighting and cooling. Water pumps that operate partly during peak hours and refrigerators are also considered important end-uses to be targeted for efficiency improvements. Also, use of electric water heaters is growing.

End Uses	Priority Weights
Lighting	30%
Cooling	18%
Water Heating	17%
Appliances	36%

DSM Implementation Strategies

Three strategies were identified by the team. Because of high initial costs of energy-efficient products and consumers' lack of awareness and/or lack of interest in replacing existing inefficient products, the use of financial incentives by the utility is ranked the highest, followed by an awareness campaign and, finally, direct installation of energy-efficient devices.

Implementation Strategies	**Priority Weights**
Financial Incentives	48%
Awareness Campaign	42%
Direct Installations	10%

B. Industrial Sector

As was mentioned earlier, the industrial sector accounts for about 40% of electricity consumption in TNEB's territory. Thus, for DSM to make a major impact, serious considerations must be given to this sector for DSM implementation.

Load shape objectives in industrial sector:

Load shape objective	Priority Weight
Strategic Load Growth	24%
Peak Clipping	24%
Load Shifting	20%
Valley Filling	20%
Strategic Conservation	12%

Higher tariff rates make this sector a profitable one for TNEB. However, because of environmental restrictions, increasing cost of land and labor, and transportation problems, most industries are moving out of the urban areas. TNEB's main concerns are demand reduction during peak hours, particularly during the evening peak period and meeting growing industrial demand for power. By providing sufficient incentives through a new TOD tariff, some industries may shift their loads to off-peak hours.

End Uses in the Industrial Sector

The following end-uses were prioritized based on their contributions to the load shape objectives of TNEB in this sector.

End-Uses	Priority Weight
Motive Power	24%
Process	43%
Lighting	6%
Cooling	27%

DSM Implementation Strategies

Four implementation strategies (appropriate tariff structure, direct installation, financial incentives, and awareness campaign) were identified for this sector. These strategies were prioritized based on their effectiveness in improving energy efficiency of each end-use listed above. The following are composite weights of these strategies:

Implementation Strategies	Priority Weights
Tariff incentives	23%
Direct Installation	7%
Financial Incentives	31%
Awareness campaign	39%

A utility's primary concern in selecting a DSM program is its financial impact on the utility. There are a large number of variables affecting a DSM program's financial feasibility, e.g., future

tariffs, future capacity costs, and fuel costs. Because there are great uncertainties regarding each of these factors and their impacts on TNEB, our analyses are based on the following assumptions:

1. No change in existing tariffs
2. No change in import tariffs
3. New capacity is coal-based at a cost of Rs. 12,127/kW per year
4. Variable costs for new generation of Rs. 1/kWh
5. T&D losses are 17% for LT and 5% for HT customers

The results of this analysis as shown in *Tables 3* and *4*.

Table 3: Financial Impacts of DSM Programs on TNEB Based on Savings of 1 kW Peak Demand
In Rupees

Tariff Categories	Loss of Revenues	Avoided Costs (New Generation)	Net Gain / Loss (New Generation)
HT (I)	-131	1,061	930
HT (II)	-105	1,061	956
HT (III)	-157	1,061	904
HT (IV)	0	1,061	1,061
LT (I)	0	1,182	1,182
LT (II)	0	1,182	1,182
LT (IIIA)	0	1,182	1,182
LT (IIIB)	-146	1,182	1,036
LT (IV) Agriculture	0	1,182	1,182
LT (V)	0	1,182	1,182
Public Lighting & Water	0	1,182	1,182

Table 4: Financial Impacts of DSM Programs on TNEB Based on Savings of 1 kWh
In Paise

Tariff Categories	Loss of Revenues	Avoided Costs - New Gen.	Net Gain/ Loss - New Gen.
HT (I)	-299	105	-194
HT (II)	-226	105	-121
HT (III)	-310	105	-205
HT (IV) Lift Irrigation	-26	105	79
LT (I)	-163	117	-46
LT (II)	-287	117	-170
LT (IIIA)	-226	117	-109
LT (IIIB)	-351	117	-234
LT (IV) Agriculture	0	117	117
LT (V)	-410	117	-293
Public Lighting & Water	-195	117	-78

As *Table 4* shows, based on the cost of new power generation of 117 Ps/kWh (including 17% T&D loss reductions), TNEB would gain from kWh reductions only in HT (IV) and in LT(IV) categories. However, to calculate avoided costs resulting from DSM implementation, one must consider both energy and demand savings for a particular end- use in a sector. The following example illustrates how this is done.

Example 1:	*Reduction in Energy Consumption for Lighting in LT Residential Customers*
Assumptions:	
Number of customers	1,000,000
Total monthly energy use	300 kWh or less
Average reduction in peak demand	50W
Total reduction in peak demand	50 MW
Average operating time per day	3 hours
Existing light bulbs are replaced with CFL or energy efficient fluorescent lighting systems	
Analysis	
Annual reduction in energy consumption	54.75 million kWh
Annual reduction in energy production	64.41 million kWh
Reduction in power requirements	58.82 MW
Reduction in power requirements assuming 90% PF	65.36 MVA
Average selling price	138 P/kWh
Annual loss of revenues	76 million Rs
Average cost of new generation	117 P/kWh
Capacity cost	1,182 Rs/kW per month
Annual reduction in energy costs	75 million Rs
Annual reduction in capacity costs	914 million Rs
Net annual gain to TNEB	**913 million Rs**

There are eight distribution regions within TNEB territory, and Chennai is one of them. The number and type of customers in this region are as follows:

Customer Category	Number of Customers
HT Supply	1,400
LT Supply	
LT Domestic	1,020,755
LT Public Lighting	5,935
LT Public Water Supply	2,484
LT Cottage Industries	11
LT Industrial	71,712
LT Agricultural	65,420
LT Huts	91,824
LT REC< END Institutes	5,173
LT Studios/Cinemas	63
LT Others	222,337
LT Temp Supply	1,105
LT Total	1,488,219
LT Total kW	3,664,164

Other Miscellaneous Information

- T&D total losses: 17%
- They have installed TOU meters at HT industrial sites and have implemented TOU tariff. TOU tariff is a two-part tariff with a 20% penalty for power use during peak hours (6-9 PM). This penalty only applies to kWh. Demand charges are the same during the peak and off-peak hours. They have a proposal to reduce tariffs during off peak hours and modify the two-part tariff to accurately reflect the daily load curve.
- Mandatory Energy Audits
  Energy audits are mandatory for all HT industrial consumers with contract demand of more than 2000 kVa.
- The evening peak is mainly due to lighting and air conditioning. The air conditioning load is increasing. Also, water pumping in domestic and agricultural sectors contribute to this peak. This problem becomes very serious during February and March
- In industries, motors and furnaces (in steel and iron industries) are major loads.
- Diversity factor for industries is 1.2 and for agriculture is 1.5
- In industries 10% are three-shifts, 50% are two-shifts, and the rest 40% are one-shift.
- "We are interested in DSM, but the decision must be made by consumers."
- "Industrial consumers are aware of the benefits of DSM, but others are not."
- Electricity is free for agricultural consumers in Tamil Nadu. They are asked not to use power during peak hours on a voluntary basis.
- The pumps and a 140-W light bulb are on a separate line with no meters. However, the farmers' residences are treated the same as other LT domestic consumers.
- DSM proposals include remote control of agricultural pumps, capacitor installations on LT and HT lines, and high voltage distribution lines (11kV). Also, installation of energy efficient transformers.
- Capacity costs are 50,000 Rs/kW; marginal cost is about 228 Ps/unit and average sales are about 195 Ps per unit. So, there is a loss of 33 Ps/unit.
- According to Mr. Thanagarathnam, 1,500 crore Rs/year is lost because pf the free power supply to the agriculture sector. However, the government pays 300 crore Rs/year for subsidies compensation.
- Rate of power growth is 7%-8% per year, and rate of power demand is 10%-15% per year. The gap must be met through DSM.
- Recommendation: IRP must be mandatory for utilities; DSM targets must be set by the utilities, and DSM achievements must be reported annually.
- Cost of power imports is from 90 to 135 Ps/unit plus a 3 Ps/unit for transmission access.

3. DEMAND-SIDE MANAGEMENT CONFERENCE

Program and Participants

The program agenda for the AEC-DSM USAID DSM Conference on "DSM Opportunities and Barriers in India" is given in Appendix VI. A paper titled "Paving the Way for India's Electrification Through Demand-Side Management" that was presented by RMA is attached in Appendix VII.

The participants came from government agencies, utilities, NGOs, private sector, etc. The break-up of participants is given below:

1. Utilities

- Andhra Pradesh SEB
- Himachal Pradesh SEB
- Haryana SEB
- Gujarat SEB
- Surat Electricity Company
- National Thermal Power Corporation
- Gujarat Industrial Power Corporation
- Gujarat Power Corporation

2. Governmental Agencies

- Energy Management Center
- Prototype Development and Training Center
- Indian Renewable Energy Development Agency
- Electrical Research and Development Association
- Office of Commissioner of Electricity
- Ahmedabad Municipal Corporation

3. Non-Governmental Organizations (NGOs)

- Consumer Education and Research Center
- Gujarat Chamber of Commerce and Industry

4. Educational Institutions

- School of Planning
- Indian Institute of Management

5. Consulting Firms, ESCOs, and Manufacturers

- Asian Electronics/ Asian Energy Management
- Thermax Energy Performance Service
- Devki Energy Consultancy

- Alliance to Save Energy
- JYOTI
- Agri Team- Canada

Brief Notes on DSM Issues Discussed at the Conference

Dr. Natarajan, Energy Management: Center:

- Oil and gas sectors are controlled by the Central Government, but the electricity sector is controlled by the Central as well as State Governments.
- States did not raise the funds needed by the power sector.
- Long lead time requirement is a barrier in getting information from the States
- Ministry of Power has to check with many states to investigate the impacts of power development on each state.
- All utilities undertake planning activities only on the supply side. In some utilities, renewables (wind farms) also came into the picture.
- IRP should make commercial sense.
- There is absence of information on benefits and techniques of IRP.
- The Electricity Supply Act of 1910 and 1948, under various clauses, clearly charges the government to ensure efficiency in generation, transmission, distribution, and end use.
- BIS ACT. The job of BIS is to ensure that products are available at reasonable cost. Also, safety and energy efficiency. There are not adequate testing facilities to monitor the product quality and efficiency.
- State Amendments. Compulsory Energy Audits. The problem is lack of sufficient energy audit firms. There are 60,000 HT industries with more than 1 MW demand. But there are only 20 auditing firms in large cities and 10 in small ones. The industries are carrying out the audits, but no one is following their implementation.
- Legislation is outside the utility control.
- Mandate IRP. We could have done it 10 years ago. Each state wants to be independent.
- Several states have already begun the process of forming a regulatory commission.
- There will be a Central Regulatory Commission.
- Energy efficiency as business has enormous scope.
- The government should provide the initial support for ESCOs.
- There must be a mix of regulation plus market forces.
- Consumer acceptance and cooperation is important.
- Utilities are not the only players.
- We must sell what the market wants.
- Somebody must bring them (players...industry association, CERC, BIS, and the government) together to identify policies
- Short supply of information.
- Both industries and consumers want to resort to legislation, but this is not the answer.
- Utilities have worst public relations.
- Manufacturers are not advertising energy efficiency.
- In today's information age, decisions are based on information.
- Plant load factor was 54% in 1985-87, is now 64%, and will improve.
- Switching off the feeders and a means of load management is not DSM.

Mr. Khumri, Commissioner of Electricity-Gujarat:

- Regulation to promote DSM.
- States must implement government orders
- Government of India must direct state governments for stricter implementation of these orders--energy audits, households appliance quality control, and BIS standards.
- Energy audits requirements have generated many audit reports. No penalties or benefits and no feedback.
- Energy conservation was not properly stated in the Acts.
- Bombay Act dealing with Gujarat and .... control supply, T&D and use of electricity
- Government of Gujarat will actively support energy conservation--incentives and penalties are required--no cash incentives
- We should have proper institutions and workforce.
- Massive awareness programs--running ads on the city cable
- Subsidies--Government has the "minimum national action plan??" to increase the agricultural tariff to 50 Ps and to 50% of the average cost of supply in 3-5 years.
- Tariff revisions--8,000 farmers pay that type of tariff

Richard Edwards, USAID:

- India will become the world's fourth-largest economy in the 21st century.
- Legislation is needed at the State and Central Government level.
- Next phase of EMCAT will involve policy studies.
- Mark Twain said, "Everybody talks about the weather, but nobody does anything about it."
- Policy support and capital mobilization is needed.

Professor Manubhai Shah, CERC:

- The role of consumer organizations.
- The major barrier is not energy savings, but availability of electricity and power quality.
- Crisis of confidence
- Also plant load factor, T&D loss reduction, and dealing with theft.
- Consumers see enormous waste on the supply side.
- What is needed is also informing consumers and monitoring standards.
- Quality of power stop at consumer's door.
- Corporate objective of utility should be meeting the demand in quality, quantity, and time and telling the consumers the cost of power

Significant Points in the Panel Discussion Session

General

- Client-consultant relationship...CERC has no problem with Client/Consultant relationship
- Cost of energy is a large percentage of household's daily cost.
- Voluntary vs. statutory
- Standards should become compulsory in a set time.

- Gupta--BIS.
- Efficiency should be easily measurable.
- BIS should enforce their standards more frequently and more seriously.

Regulatory

- Access to transmission lines across state boundaries.
- Mandatory energy audits. Energy audits of three states have expert committees. What to do about it? There are technological and legal issues. The industries make no comments on the audit
- State and central electricity regulatory commission...they are looking at tariffs.
- Government, industry and consumers must come together to discuss these issues.
- Power trade issues among states..there is no coordination.
- There must be a maximum fixed wheeling charges.

Consumer Awareness

- Data collection (AEC., TERI, CERC).
- Energy parks and energy centers.
- Training.
- Real life case studies--let the people who benefit from DSM to propagate it.
- Publication, AV in many languages.
- Marketing and finance--the sales people must be trained.
- Training and education programs.
- Who should do awareness? It requires a system and we do not have that system.
- High school energy education curriculum.
- Dr. Natarajan said that the Ministry of Power has allocated Rs. 1.5 crore for awareness and want to increase it to Rs. 3-4 crore. The response is 75,000 letters from all over the country
- Energy efficiency award..not good response from the states. Out of 60,000 HT industries, only 100-120 apply for the energy efficiency award.
- How various stakeholders can work together.
- Utilities should provide information
- Consumers groups should be involved in creating awareness .
- There are 700 consumer groups in India.
- Creating markets for energy efficient products in India...Market "pull" vs market "push."

Standards and Labeling

- It has been proposed to begin on the voluntary basis.
- 3 items are selected: refrigerator, AC, and water heaters..BIS has developed the first draft.
- If all the other parameters developed by BIS are compulsory why not energy efficiency be also compulsory.
- Motors must also be mandatory

Finance

- IDBI..Of the $150 million for energy efficiency loan to industries, $120 million has already been given. We may also consider loan for another line item..to ESCOS. Asian Electronics capacitor installation program is proposed.
- Financial institutions do not have concessionary funds. We charge at normal rates.
- Since DSM has shorter gestation period and faster payback than the supply side, financial institutions should offer lower rates.
- The pivotal role by the utility.
- IDBI is only interested in large projects.
- IDBI should play a role in financing small-scale DSM projects.
- IREDA..More than 1,000 projects has been done over 10 years...World Bank $40 million, ADB, and Japan..Right now they have projects with a budget of Rs. 115 crore.

Strategies and Policy Recommendations for Accelerating Implementation of DSM Programs in India

Based on the conference proceedings and the discussions held with the key members of the energy efficiency community the following strategies and policies are recommended:

Improving Electricity Tariffs

One of the necessary prerequisites of efficient electricity use is tariffs that reflect appropriate price signals. Present tariff structure reflect neither marginal costs nor embedded costs in each sector. Agricultural rates and some residential rates cover less than 50% of the costs, while HT industrial rates recover well over 100% of the costs. Tariffs must reflect the true cost of providing electricity. Power quality problems, including voltage and frequency fluctuations, will also prevent the use of some cost-effective technologies, such as fluorescent or CFL lights with mechanical ballast and variable-speed drives. Voltage stabilizers can be used to compensate for voltage problems but this reduces cost-effectiveness.

Suggested Solutions

1. Develop cost-based tariffs, while, at the same time, developing better mechanisms for subsidizing poor households and farmers.

2. Install Time-Of-Use (TOU) meters and develop effective TOU tariffs for large commercial and industrial consumers. Impact of TOU tariffs on consumers and elasticity of demand must be studied scientifically before any tariff development. There must be substantial tariff differentials for peak and off-peak periods. This will encourage expansion of businesses and industries that could operate during off-peak hours. It will also encourage load shifting to large consumers such as thermal storage.

3. Develop interruptible tariffs to encourage customers install back up generators for peak periods.

4. Replace old, defective meters with new ones.

5. Develop research capabilities of the utilities, including load research and power quality improvements.

6. Conduct a cost/benefit analysis for direct control of agricultural pumps, and encourage use of solar, wind, and other renewable technologies for agricultural pumps.

7. Privatize distribution system. Profit motivation and cost minimization would help reduce losses, particularly, commercial losses, and improve the billing and collection practices.

8. Collect end-use appliance and equipment data to develop detailed conservation potential estimates and help target conservation programs.

9. Consider power quality problems in the design of DSM programs.

Increasing Demand for Energy-efficient Equipment

If energy-efficient technologies are to achieve a significant level of market penetration, it is necessary to stimulate customer demand for efficient technologies. While market for efficient technologies may originate through the efforts of equipment manufacturers to ***"push"*** their technologies through the marketing infrastructure, it is ultimately a market ***"pull"*** that will sustain a robust market for efficient technologies. Increasing customer demand for efficient technologies is necessary to stimulate the expansion of the market infrastructure, and this expansion will, in turn, prepare the marketing infrastructure for further expansion. Without significant market pull, the marketing infrastructure for efficient technologies will stagnate, and market expansion will cease.

Limited customer awareness of efficient technologies is the primary marketing infrastructure barrier in all sectors. This problem is particularly acute in the residential sector.

The high initial cost of energy-efficient equipment is another obstacle that keeps energy-efficient technologies from penetrating the marketplace in all customer sectors. In India, as in many other countries, consumers focus on first cost rather than life-cycle cost when making equipment purchasing decisions. Since energy-efficient equipment normally costs more than standard equipment, it is less likely to be selected. In many industries, equipment purchase decisions are normally made by those who are not responsible for paying the electricity bills. For them, speed of product delivery and lower initial costs are the most important criteria in their purchasing decisions.

Suggested Solutions

1. Increase public awareness using the news media and by establishing energy conservation centers. These centers could provide easy access to energy efficiency services and products information for consumers to make informed choices on energy consuming equipment.

2. Increase consumer awareness using case studies and demonstration projects in similar industries.

3. Provide free energy audit services to residential and small commercial and industrial consumers.

4. Make annual energy audits mandatory for large commercial and industrial consumers.

5. Require implementation of all energy audit recommendations with pay backs of less than one year.

6. Follow up on DSM implementation by consumers, and facilitate implementation of energy audit recommendations through ESCOs.

7. Set standards and implementation targets for energy intensities in industries, and require industries to report energy intensities of their operations in their annual reports.

8. Require assignment of energy managers for large industrial and commercial facilities.

9. Facilitate DSM implementation through ease of financing, direct installations of energy-efficient equipment, and financial incentives.

Institutional Reform

Another element that is necessary for the successful implementation of DSM programs is an infrastructure in the economy that can deliver, sell, install, and maintain energy-efficient technologies. This include availability of domestically produced energy-efficient equipment, availability of reasonable financing, and existence of effective governmental institutions.

Suggested Solutions

1. Accelerate privatization of electric utilities.

2. Speed up creation of Regulatory Commissions, which would hopefully lead into a cost-based tariff for different sectors and create a more predictable environment for the utilities.

3. Accelerate market transformation of energy-efficient products through mandatory codes and standards.

4. Set deadlines for mandatory standards on end-use products, particularly for motors and pumps.

5. Develop appliance rating schemes. Provide information on energy efficiency at the point of sale for consumers to make informed decisions on product purchases.

6. Establish credible, independent testing centers for energy-efficient products. Facilitate consumers to test products at these testing centers.

7. Develop the skills and expertise to market energy efficiency projects. This requires two elements. First, there must be sufficient business available to encourage existing firms to expand or to attract new entrants. Then, it is necessary to provide both training and experience to allow these firms to become successful.

8. Develop energy conservation programs in State-owned facilities using ESCOs. Make public facilities more efficient, incurring little or no capital costs, by getting the State Energy Minister to mandate energy efficiency improvements over time. Use Energy Service Companies to implement these measures.

9. Make Integrated Resource Planning (IRP) mandatory and require utilities to report their DSM activities annually.

10. Provide tax benefits and lower custom duties for manufacturers and importers of energy-efficient products.

11 Promote greater involvements of NGOs such as CERC, PUBLIC, and FOSET. These organizations could play an important role in increasing consumer awareness and in providing independent testing and evaluation of end-use products.

12. Develop certification programs for motor rewinding firms and energy auditors.

13. Develop better financing mechanisms for energy efficiency measures

14 Develop educational and training programs for engineering students, energy auditors, ESCOs and energy managers.

15. Investigate costs and benefits of daylight saving time changes.

16 Create a National Forum for the development, implementation, and monitoring of energy efficiency activities in India.

APPENDIX I
Business Cards of People Met During the Trip

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22

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E

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APPENDIX II
Sample Life-Cycle Cost Analysis for Energy-efficient Appliances

SIMPLIFIED COST-BENEFIT ANALYSIS FOR RESIDENTIAL ELECTRICAL APPLIANC

On this Sheet (Basic_Information) please input or change the parameters

Analysis Done On:

Basic Information:	Your Input
Discount (or Nominal Interest Rate) in %	[illegible]
Expected Annual Inflation Rate in %	[illegible]
Real Interest Rate in %	8.0
Current Residential Electricity Price in Rs. per KWH	[illegible]
Electric Utility Profit Margin (Price-to-Cost Ratio)	[illegible]
Expected Real Electricity Price Escalation (Annual %)	[illegible]
Share of Coal-Fired Generation (in %)	[illegible]

APPLIANCE DETAILS

End-Use: [redacted]
Capacity: [redacted]
Product Type: [redacted]

EXAMPLE ONLY

Input Information:

	Base/Existing Applianc	New/Efficient Applia	Best Available Technolo
Brand Name	[redacted]	[redacted]	Whirpool - USA
Retail Cost in Rs.	[redacted]	[redacted]	12000
Annual Usage in no. of hrs. per yr	[redacted]	[redacted]	[redacted]
Expected Useful Life in yrs.	[redacted]	[redacted]	15
Expected Salvage Value in Rs.	[redacted]	[redacted]	Rs 2,000
Electricity Consumption in KWH/day	[redacted]	[redacted]	0.65

Energy Consumption in KWH per yr.	456	365	237

CUSTOMER COST-BENEFIT ANALYSIS (FOR ENERGY EFFICIENCY OPTION)

Appliance Cost in Rs.	Rs 8,500	Rs 9,500	Rs 12,000
Current Annual Energy Cost in Rs.	Rs 684	Rs 548	Rs 356
Simple Payback in yrs.		7.3	10.7
PV of Lifetime Energy Cost in Rs.	Rs 6,647	Rs 5,317	Rs 3,456
PV of Salvage Value in Rs.	Rs 315	Rs 378	Rs 630
PV of Life-Cycle Cost in Rs.	Rs 14,832	Rs 14,439	Rs 14,826
PV of Life-Cycle Customer Net Benefits in Rs.		**Rs 392**	**Rs 6**

ELECTRIC UTILITY COST BENEFIT ANALYSIS (FOR ENERGY EFFICIENCY OPTION)

Unit Annual Energy Savings in KWH	91.3	219.0
Unit Annual Capacity Savings in W	10.4	25.0
Annual Revenue Lost per Appliance in Rs.	Rs 137	Rs 329
PV of Lifetime Revenue Lost in Rs.	Rs 1,329	Rs 3,190
Unit Avoided New Capacity Cost in Rs.	Rs 521	Rs 1,250
PV of Life-Cycle Avoided Operating Cost in Rs.	Rs 1,063	Rs 2,552
PV of Life-Cycle Utility Net Benefits in Rs.	**Rs 255**	**Rs 612**

ENVIRONMENTAL BENEFIT ANALYSIS (FOR ENERGY EFFICIENCY OPTION)

Unit Annual Reduced CO_2 Emissions in KGS.	24.13	57.92
Unit Annual Reduced SO_2 Emissions in KGS.	0.16	0.39
CO_2 Externality Cost in Rs. per KG	Rs 0.54	Rs 0.54
SO_2 Externality Cost in Rs. per KG	Rs 159.86	Rs 159.86
Unit Annual Avoided CO_2 Emissions Cost in Rs.	Rs 13	Rs 31
Unit Annual Avoided SO_2 Emissions Cost in Rs.	Rs 26	Rs 62
Unit Annual Avoided Environmental Cost in Rs	Rs 39	Rs 93
PV of Life-Cycle Environmental Benefits in Rs.	**Rs 332**	**Rs 797**

APPLIANCE DETAILS

End-Use: [redacted]
Capacity: [redacted]
Product Type: [redacted]

EXAMPLE ONLY

Input Information:

	Base/Existing Appliance	New/Efficient Appliance	Best Available Technology
Brand Name	[redacted]	[redacted]	Imported
Retail Cost in Rs.	[redacted]	[redacted]	Rs 32,000
Annual Usage in no. of hrs. per yr	[redacted]	[redacted]	[redacted]
Expected Useful Life in yrs.	[redacted]	[redacted]	15
Expected Salvage Value in Rs.	[redacted]	[redacted]	Rs 10,000
EER in Btu per watt-hour	[redacted]	[redacted]	12

Energy Consumption in KWH per yr.	2433	2190	1825

CUSTOMER COST-BENEFIT ANALYSIS (FOR ENERGY EFFICIENCY OPTION)

Appliance Cost in Rs.	Rs 25,000	Rs 28,000	Rs 32,000
Current Annual Energy Cost in Rs.	Rs 3,650	Rs 3,285	Rs 2,738
Simple Payback in yrs.		8.2	7.7
PV of Lifetime Energy Cost in Rs.	Rs 35,450	Rs 31,905	Rs 26,587
PV of Salvage Value in Rs.	Rs 3,152	Rs 3,152	Rs 3,152
PV of Life-Cycle Cost in Rs.	Rs 57,297	Rs 56,752	Rs 55,435
PV of Life-Cycle Customer Net Benefits in Rs.		**Rs 545**	**Rs 1,862**

ELECTRIC UTILITY COST_BENEFIT ANALYSIS (FOR ENERGY EFFICIENCY OPTION)

Unit Annual Energy Savings in KWH	365	912.5
Unit Annual Capacity Savings in W	166.7	416.7
Annual Revenue Lost per Appliance in Rs.	Rs 365	Rs 912
PV of Lifetime Revenue Lost in Rs.	Rs 3,545	Rs 8,862
Unit Avoided New Capacity Cost in Rs.	Rs 8,333	Rs 20,833
PV of Life-Cycle Avoided Operating Cost in Rs.	Rs 2,836	Rs 7,090
PV of Life-Cycle Utility Net Benefits in Rs.	**Rs 7,624**	**Rs 19,061**

ENVIRONMENTAL BENEFIT ANALYSIS (FOR ENERGY EFFICIENCY OPTION)

Unit Annual Reduced CO_2 Emissions in KGS.	96.53	241.33
Unit Annual Reduced SO_2 Emissions in KGS.	0.65	1.62
CO_2 Externality Cost in Rs. per KG	Rs 0.54	Rs 0.54
SO_2 Externality Cost in Rs. per KG	Rs 159.86	Rs 159.86
Unit Annual Avoided CO_2 Emissions Cost in Rs	Rs 52	Rs 129
Unit Annual Avoided SO_2 Emissions Cost in Rs.	Rs 104	Rs 259
Unit Annual Avoided Environmental Cost in Rs	Rs 155	Rs 388
PV of Life-Cycle Environmental Benefits in Rs.	**Rs 1,329**	**Rs 3,322**

APPENDIX III
BIS Amendments for Introduction of Labeling for Energy Efficiency

PROPOSED
DRAFT AMENDMENT NO. 6 JULY 1997

TO

IS 1476:1976 SPECIFICATION FOR DOMESTIC REFRIGERATORS (MECHANICALLY OPERATED)
(*Second Revision*)

[*Page* 27, *Clause* **13.3** (Also *see Amendment No.* 3)] - Add the following clause after **13.3**:

"**13.4** The domestic refrigerator may also be energy labelled. (Ref. Appendix B)"

(*Page* 28, *Clause* **A-1.2**) - Add the following Appendix B after this clause:

"APPENDIX B
(*Clause* **13.4**)

REQUIREMENTS FOR ENERGY LABELLING

B-1 SCOPE

B-1.1 This Appendix applies to energy labelling of domestic refrigerators (mechanically operated).

B-2 MARKING

B-2.1 The following information shall be clearly and indelibly indicated on energy labels besides any other additional information as considered appropriate.

i) Monogram of energy labelling.
ii) Rated energy consumption in 24 hours under test conditions _____ kwh. when tested in accordance with IS 1476:1976.
iii) Name and trademark of manufacturer.
iv) Model No.
v) Type of refrigerator.
vi) Gross volume of refrigerator in litres.

(BISDG NOTE - Format and design of monogram for energy labels is under consideration).

Doc: HMD 03(0425)P1

B-4 METHOD OF MEASUREMENT AND CRITERIA FOR CONFORMITY

B-4.1 The rated energy consumption of the domestic refrigerator when measured in accordance with **10.11** shall conform to the energy consumption values declared by the manufacturers but it shall not exceed the values specified in **10.11.3** and **10.11.4**.

(**BISDG NOTE** - It is proposed to indicate the energy consumption of the refrigerators in the form of a bar giving rated energy consumption values and the values specified in **10.11.3** and **10.11.4** for the purpose of energy labeling.)"

PROPOSED
DRAFT AMENDMENT NO. 2 JULY 1997

1

IS 1391(PART 1):1992 ROOM AIR CONDITIONS - SPECIFICATIONS: PART 1 UNITARY AIR CONDITIONERS
(*Second Revision*)

(*Page* 4, *Table* 1) - Substitute '600' in place of '900' as the width Wmm, *Max* in case of refrigerators of capacity 1500 kcal/h.

(*Page* 4, *Clause* **7.1.1**) - Delete.

(*Page* 7, *Clause* **10.5.3.1**, *second line*) - Substitute '4 hours' for '12 hours'.

(*Page* 7, *Clause* **10.5.3.2**) - Substitute the following for the existing matter:

"**10.5.3.2** *Requirements* - At the end of 4 hours of operation, any accumulation of ice or frost on the evaporator shall not cover more than 50% of the indoor side face area of the evaporator coil."

(*Page* 8, *Table* 2) - Add the following note below Table 2:

"**NOTE** - The maximum power consumption for capacities other than those indicated above shall be interpolated."

(*Page* 9, *Clause* **10.11**, *2nd line*) - Substitute "Fig. 7" in place of "Fig. 8".

(HMD 03)

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PROPOSED
DRAFT AMENDMENT NO. 1 JULY 1997

TO

IS 1391(PART 2):1992 ROOM AIR CONDITIONERS - SPECIFICATION: PART 2 SPLIT AIR CONDITIONERS
(*Second Revision*)

(*Page* 2, *Clause* **3.1.11**) - Add the following clauses after 3.1.11:

"**3.1.12** *Energy Efficiency Ratio* (EER)

Energy efficiency ratio is defined as the quotient of the nominal cooling capacity in kilojonls per hour divided by electrical power input in watts.

3.1.13 *Rated Power Consumption*

The power consumption of the air conditioner as stated by the manufacturer at the nominal cooling capacity of the unit."

(*Page* 18, *Clause* **17.2**) - Add the following clause after **17.2**:

"**17.3** The room air conditioners may also be energy labelled (*see* **Annex E**)."

(*Page* 21, *Clause* **D-1**) - Add the following Annex at the end of this clause:

"ANNEX E
(*Clause* 17.3)

REQUIREMENTS FOR ENERGY LABELLING

E-1 SCOPE

E-1.1 This Annex applies to energy labelling of room air condition of split type.

E-2 MARKING

E-2.1 The following information shall be clearly and indelibly indicated on energy labels besides any other additional information as considered appropriate:

1) Monogram of energy labelling.
2) Name or trademark of the manufacturer.
3) Model.
4) Cooling capacity.
5) Rated power consumption.
6) Frequency and phase of power supply.

PROPOSED
DRAFT AMENDMENT NO. 3 JULY 1997

TO

IS 1391(PART 1):1992 ROOM AIR CONDITIONERS - SPECIFICATION: PART 1 UNITARY AIR CONDITIONERS
(*Second Revision*)

(*Page* 2, *Clause* **3.1.20**) - Add the following clauses after **3.1.20**:

"**3.1.21** *Energy Efficiency Ratio* (EER)

Energy efficiency ratio is defined as the quotient of the nominal cooling capacity in kilojonls per hour divided by electrical power input in watts.

3.1.22 *Rated Power Consumption*

The power consumption of the air conditioner as stated by the manufacturer at the nominal cooling capacity of the unit."

(*Page* 19, *Clause* **18.2**) - Add the following clause after **18.2**:

"**18.3** The room air conditioners may also be energy labelled (*see* Annex E)."

(*Page* 22, *Clause* **D-1**) - Add the following Annex at the end of this clause:

"ANNEX E
(*Clause* **17.3**)

REQUIREMENTS FOR ENERGY LABELLING

E-1 SCOPE

E-1.1 This Annex applies to energy labelling of room air condition of unitary type.

E-2 MARKING

E-2.1 The following information shall be clearly and indelibly indicated on energy labels besides any other additional information as considered appropriate:

1) Monogram of energy labelling.
2) Name or trademark of the manufacturer.
3) Model.
4) Cooling capacity.
5) Rated power consumption.
6) Frequency and phase of power supply.

Doc: HMD 03(0429)P1

7) Value of energy efficiency ratio with the words "Energy Efficiency Ratio _____ when tested in accordance with IS 1391(Part 1):1992.
8) The words "For units with the same cooling capacity, higher EER means lower power consumption".

(BISDG NOTE - Format and monogram of energy labels is under consideration).

E-3 METHOD OF MEASUREMENT

E-3.1 The rated power consumption of room air conditioner shall be measured in accordance with **10.8** under the conditions laid down in **9.1**.

E-4 ASSESSMENT OF TEST RESULT

E-4.1 To qualify for energy labelling, the power consumption of the air conditioner shall not exceed the values of rated power consumption as stated by the manufacturer. The rated power consumption shall also not exceed the values specified in **10.8.4**.

E-4.2 Energy efficiency ratio shall be calculated by dividing the nominal cooling capacity of the air conditioners by the value of power consumption observed in accordance with **E-3.1** and shall be marked on the energy label (*see* **E-2.1**)."

(HMD 03)

For BIS Use Only Doc: ETD 32(5018)P1

BUREAU OF INDIAN STANDARDS

Draft AMENDMENT No. 2

TO

IS: 2082:1993 STATIONARY STROAGE TYPE ELECTRIC WATER HEATERS(FOURTH REVISION)

(Page 3, clause 8.1.1)- Add the following clause after this clause:

8.1.2 The stroage type electric water heaters may also be energy labelled (Refer Annex A)

(Page 6, Clause 16.2.2, line 3)- Replace '+10' by '+5'

(Page 8, Clause 24.3) Add the following Annex after this clause:

ANNEX A
(Clause 8.1.2)

A-1 SCOPE

A-1.1 This annex applies to energy labelling of stationary storage type electric water heaters for household and similar purposes.

A-2 MARKING

A-2.1 The following information shall be clearly and indelibly indicated on energy labels besides any other additional information as considered appropriate:

'i) Monogram of energy labelling

ii) Energy consumption in 24 hours

under test conditions ..... Units

BISDG NOTE- Format and Monogram of energy labels is under consideration.'

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A-3 METHOD OF MEASUREMENT

A-3.1 The energy consumption of the startionary stroage type electric water heaters shall be measured as given in clause 16.

A-4 ASSESSMENT OF TEST RESULTS

A-4.1 To qualify for energy labelling, the stationary stroage type electric water heaters shall comply with the requirements of standing losses specified in Table 1.

A-4.2 The stroage type electric water heaters are catagorized as under based on energy consumption for the purpose of energy labelling:

Category	Declared Consumption	Remarks
1.	Mere compliance with the values specified in Table 1 for standing losses.	Will qualify for energy labelling. 20/40 mfrs
2.	Declared standing losses are ≤ 90% of the values specified in Table 1.	Will Qualify for energy labelling with improved grading. 5/8
3.	Declared standing losses are ≤ 80% of the values specified in Table 1.	will qualify for energy labelling with further improved grading. 5/10

NOTE- The stroage type electric water heaters shall confirm to the declared category even after taking into consideration the tolerances.

BISDG NOTE- It is proposed to indicate the grading by suitable additional markings on the logo for energy labelling.

(ETD 32)

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APPENDIX IV
Energy Efficiency Standards and Labeling Paper and Presentation at the August 29 Conference

Energy Efficiency Standards and Labeling Initiative in India:

An Evaluation of Status, Barriers, and Potential

August 1997

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ENERGY EFFICIENCY STANDARDS AND LABELING INITIATIVE IN INDIA: AN EVALUATION OF STATUS, BARRIERS, AND POTENTIAL

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ABSTRACT

The potential for energy conservation through the use of energy efficient appliances in India is significant but remains largely untapped. A few energy efficiency standards exist, but majority of those are weak compared to the international standards. There is no mandatory policy of comparative labeling for energy efficiency. Some voluntary endorsement labels have been formulated at the federal level, but they too are inadequate and practically ineffectual in influencing consumer decisions toward energy efficient appliance purchases. Not only the facilities are lacking for meeting testing requirements but also a significant share of appliance production continues to be in the unorganized sector. These and other barriers constrain the implementation of standards and labeling practices. The paper examines the scope of reducing energy consumption by creating stronger standards and establishing a system of labeling for energy efficiency of electrical appliances. The paper reviews the status of current energy efficiency standards in India in an international perspective. The infrastructural aspects, institutional barriers, and implementation issues are addressed.

INTRODUCTION

Energy efficiency plays an important role in global sustainable development. In developing countries like India, where generation capacities lag far behind fast-rising demand for electric power, energy efficiency improvements can slow the growth in energy consumption and additional capacity requirements, thereby producing economic and environmental benefits. India must therefore give serious consideration to energy conservation in order to meet growing electricity requirements. At present, expected contributions from end-use efficiency improvements are generally indicated in percentage terms merely as a possibility without specific annual targets. In-house reports from the Energy Management Center (EMC), the energy efficiency arm of the India's Department of Power, indicate that as much as 5,000 MW of power per year could be saved through energy efficiency measures. Residential sector alone has an end-use energy efficiency potential of 20 percent *[9]*. World Bank reports have also recommended a variety of measures which could be implemented much less expensively than supply additions *[19]*.

Energy efficient appliances have started to become available in the Indian market, due to the recent economic liberalization and competitive policies of the government. The access to international markets has also become easier through many technology transfer programs. But, considerable market and institutional barriers to energy efficiency improvements still exist *[11, 15, 16, 19, 20, 24]*. Energy efficiency standards and labeling programs, a class of energy policies that are necessary to overcome these barriers, have been virtually non-existent, or weak compared to international standards, for most energy-consuming appliances and equipment in India *[15, 16, 18, 24]*. Indian policy makers have begun to feel the need for effective standards and labeling policies. Evidence from other countries indicate that such policies are a viable and, in fact, a necessary mechanism to facilitate the availability and supply of energy efficient appliances as well as to create a consumer demand for these appliances in the market. In a way, appliance standards complement information programs,

utility demand-side management and other incentive programs, and research on new technologies in improving energy and economic efficiencies *[3]*.

The paper draws upon preliminary lessons learned in India during the initial activities of Resource Management Associates of Madison, Inc. (RMA) in this area, under a project funded by the U.S. Agency for International Development (USAID) — Energy Management Consultation and Training (EMCAT) project. The standards and labeling component of EMCAT project aims to create stronger standards, initiate labeling mechanisms for the Indian energy-efficient appliance market, and enhance testing capabilities within the country by providing technical assistance to appropriate institutions in India *[16]*. The emphasis of this activity, and this paper, is on electrical appliances, particularly the ones used by the residential consumers.

In this paper we review the status of current standards in India in an international perspective. An understanding of India's electric power challenges, its energy infrastructure, and the potential for conservation sets the stage for considering specific energy conservation measures in the first part of the paper. An assessment of institutional capabilities for energy efficiency standards, testing and labeling in India is discussed. The Bureau of Indian Standards (BIS), the federal body responsible for standards, has formulated over 15,000 standards, of which 200 address energy efficiency *[15]*. But, the latter are largely voluntary and not strong as compared with the highest energy efficiencies available internationally, or even within India. Various issues, such as the form of labeling that would be most effective for the Indian market that have to be addressed by taking into account the informational, cultural, and institutional barriers are discussed. Finally, a preliminary evaluation is made for the energy savings that could be generated through the introduction of energy efficiency standards and labeling for selected appliances.

ENERGY EFFICIENCY IMPROVEMENT IN INDIA

Industrializing countries like India need a reliable supply of electricity for economic development. Supply resources have been unable to meet the growing demand for electricity in India. But, the potential for energy conservation through the use of energy efficient appliances is large. End-use energy efficiency improvements can go a long way in balancing the need for electricity with the objectives of economic development.

Electricity Supply Problems

Chronic electric power shortages exist and the cost of new generation facilities is staggeringly high. The country has been experiencing a phenomenal annual growth of 10 percent in electricity demand, with current power generation capacity over 85,000 megawatts (MW) of electricity *[9]*. Despite high demand and the impressive growth rate of installed capacity during the past few decades, India's current power consumption per capita is just 270 kilowatt-hours (kWh) per year, compared to 8,000 kWh to 25,000 kWh in developed countries. The Central Electricity Authority, the country's central power planning and regulatory agency, has carried out generation expansion planning studies estimating that an additional capacity of about 142,000 MW would have to be added to meet demand growth by the year 2007. Meeting these needs would require funds on the order of US$ 160 billion.

Need for Energy Efficiency Policies

Current investments in the electricity supply industry have been inadequate to prevent the power shortages and brown-outs that have plagued the entire country for years, reducing industrial production. A 10 percent electricity supply cut to the industry sector, for example, can cause an estimated annual industrial production loss of more than US$ 6 billion—equivalent to 12 percent of the country's industrial output. Such losses are likely to increase in the future if business continues as usual.

The experience of developed countries and some developing nations shows that energy conservation and increased energy efficiency (more net output per unit of energy input) could play a crucial role in economic development. Numerous programs indicate that end-use energy improvement options—that is, improving energy efficiency and managing energy demand at the customer end—is often less costly than the usual supply side alternatives for increasing energy services.

Energy Efficiency Potential and Prospects

While India has begun to recognize the value of energy conservation, end-use efficiency improvements still remain a virtually untapped energy resource *[9]*. With the projected capacity deficit approaching 6,000 MW in India's eighth Five Year Plan (FYP), the National Energy Efficiency Program of the Government had targeted savings of 5,000 MW by 1994-95 *[9, 19]*. Of this, 1,550 MW of savings were in the industrial sector by upgrading energy efficiency equipment and operating and management practices. Improvements include energy-efficient motors for pumps, compressors, and fans, as well as variable speed drives for large mills, cogeneration in the sugar, pulp, paper, and cement industries, and demand-side management measures. Through the National Energy Efficiency Program, India had earmarked Rupees (Rs.) 100 billion (US$ 3.2 billion) out of

a total outlay of Rs. 11 trillion (US$ 355 billion) for the energy sector and Rs. 7.96 trillion (US$ 255 billion) for the power sector *[19]*. These 5,000 "negawatts" generated during the FYP were expected to cut as much as Rs. 1.5 trillion (US$ 48 billion) from power sector investments.

Electrical end-use efficiency can increase for lighting, refrigeration, electric motors, cooling and ventilation, air conditioning, and many other electricity uses in homes, businesses, public institutions, and industries. For instance, the scope of energy savings in industry ranges from 15 percent in the aluminum sector to 60 percent in steel. Refrigerators offer another good example: some new 165-liter Indian models consume about 540 kWh per year, more than 2-1/2 times as much energy as a new, efficient 200-liter Korean model *[19]*. Table 1 shows an approximate breakdown of some electricity end-uses and savings potential estimated by an ADB study *[1]*.

TABLE 1: SAMPLE END-USE ENERGY CONSUMPTION AND SAVINGS IN INDIA

End-Use	*Annual Values (TWh)*	
	Consumption 1989-90	*Savings Potential in 5 to 10 years*
Lighting	29	16.5
Residential (excl lighting)	12	2.9
Agricultural Pumping	32	11.0
Industrial Motors	75	31.4
Commercial (excl. lighting)	7	1.0
Municipal Water Pumping	3	--

Source: *[1]*

The EMCAT project has also contributed to ongoing research on India's market availability of energy-efficient measures (EEM) for all major end-use and technology categories (i.e., lighting, motors, HVAC, etc.). Table 2 provides the benefit-cost ratios for some sample EEMs. The benefit-cost ratio is based on estimated energy and demand savings and the actual price and performance data collected in the preliminary stages of research.

Studies so far have revealed the fact that a wide range of EEMs have started to become available in India, partly due to the recent trends toward liberalization of the Indian economy. However, barriers still exist. The equipment is generally available at a reasonable cost to customers but most dealers of EEMs are located only in major cities. However, due to lack of information and other market barriers, inadequate demand results in no supply. This in turn discourages demand, leading to a lack of availability (a "technology push versus market pull").

TABLE 2: ECONOMICS OF SOME ENERGY EFFICIENCY MEASURES IN INDIA

Average Energy Efficiency Measure	*Annual Savings*		*Capital Cost (US$)*	*B/C Ratio*
	kWh	*kW*		
Efficient Motor	4,268	1.21	5,196	2.49
Efficient Pump	2,487	0.7	936	6.07
Fluorescent Lamp	14	--	3.5	1.38
Refrigeration Compressor (Industrial)	5,459	2.32	3,224	4.53
Adjustable Speed Drives	11,249	3.18	4,410	1.00

Source: *[19]*

Capturing energy savings by adopting efficiency measures makes good economic sense. The average cost of efficiency measures *[1, 19]* is substantially lower—Rs. 8,800 per kW (US$ 284/kW)—compared to the estimated costs of adding new generation capacity—Rs. 12,900/kW for peak load (US$ 416/kW) and Rs. 23,500/kW for coal-fired base load (US$ 758/kW). In fact, the capital cost of base load plants such as gas-based combined cycle facilities along with investments in transmission and distribution lines could be as high as Rs. 60,000 per kW or US$ 1,935 per kW, according to utility industry sources.

Barriers to Energy Efficiency

Adapting the knowledge gained from the U.S. experience to develop an energy efficiency program in India requires a thorough understanding of the barriers to energy conservation in this context. Listed below are some of the barriers common to most developing countries. This section draws substantially from the extensive research articles and reports in this area (see [1], [15]) and is also based on findings in the EMCAT project.

• *Lack of Information*: Information regarding end-use energy consumption and end-use efficient equipment is difficult to obtain.

• *Limited Availability of Efficient Equipment, and Import Duties*: Many kinds of energy-efficient equipment (such as super-efficient refrigerators, CFLs, etc.) and DSM-related equipment (such as advanced metering systems) are not widely available in the Indian market. Moreover, import

duties on components required for this equipment are sometimes exorbitant. Even when efficient equipment is manufactured in India, consumers may have difficulty finding it in stock at dealerships due to lack of demand. Of course, demand remains low because the equipment is not in stock—a "technology push" versus "market pull" problem.

• *Cost Analysis Procedures*: Energy-efficient equipment often has a higher first cost than standard equipment, in part because it is generally of higher quality. At the same time, consumers tend to use higher discount rates when considering any investments in equipment. They try to keep the initial cost of equipment as low as possible, without paying much attention to operating costs. To address this common practice, customers need to receive education about life-cycle cost economics.

• *Utility Electricity Tariffs*: Electricity prices are less than the marginal costs and even lower than average production costs. This problem is more severe in the subsidized agriculture and residential sectors. Thus, price signals are incorrect, providing consumers with no incentive to conserve energy.

• *Logistical Problems and Lack of Awareness*: In general, customers in India are not aware of the value and availability of energy efficiency improvements. Those who are may opt to avoid the "hassle" of implementing something different from "business as usual." Because energy efficiency measures are relatively unproved in India, most end users are averse to taking risks associated with new technologies. Meanwhile, small industries lack staff to focus on energy work.

• *Existence of Used Equipment Market*: Any equipment in India, including energy end-use equipment, has a very long in-service life. Users fix, renovate, and recycle old equipment instead of replacing it with new, efficient options (as is the case with motor rewinding). This keeps more efficient new technologies from entering the market.

• *Decision-Making Process*: Government and utility decisions tend to be cumbersome and time -consuming. This is especially true in case of decisions involving new concepts and policies, such as the introduction of standards and new labeling programs.

• *Lack of Skilled Manpower*: Though India's has the third largest technical manpower in the world, the number of utility staff, industry staff, and private sector consultants with experience in energy efficiency issues and analytical work is small relative to the need for such skills. Much training, including training on basic analytical techniques, must be done in conjunction with the development and implementation of the new energy efficiency policies.

Energy Conservation Infrastructure and Policies

Despite moves toward liberalization, India's economy is largely centrally planned. Ministries have responsibility for specific sectors such as energy, industry, and agriculture, but it is the Planning Commission that establishes national priorities, sets policy targets, allocates budget for government activities, and develops the five-year plans. The Planning Commission—in conjunction with the Ministry of Energy—develops energy plans. The Ministry's energy conservation activities are located in the Department of Power. The independent Central Electricity Authority acts as a central advisor on electric power matters to the Department of Power, the Planning Commission, and the State Electricity Boards. The National Thermal Power Corporation builds and operates centrally owned thermal power plants and transmission and distribution (T&D) systems. The various State Electricity Boards, one in each Indian state, play a major role in the generation, transmission, and distribution of electricity. In 1990, the states held a 71 percent share of the country's total installed capacity, while the national/central sector held 25 percent and the private sector 4 percent respectively *[19]*.

Although few institutions have assigned high priority to end-use efficiency, isolated programs have emerged in recent years. With support from the European Economic Community, the Ministry of Energy's Department of Power established the Energy Management Center (EMC) in 1989. The Center's activities are to develop and promote innovative energy management techniques, train energy managers, and improve energy information systems.

Energy Efficiency Development Under EMCAT

India's Energy Management Consultation and Training (EMCAT) project, funded by U.S. AID, has two focal points—to improve the efficiency of both electricity supply and demand. Resource Management Associates of Madison, Inc. (RMA) is U.S. AID's technical assistance contractor for the demand-side component, the work for which began in 1994. RMA is working with Industrial Development Bank of India, the local technical counterpart, to implement the project. The components of the EMCAT project are: 1. Energy Audit Improvement Program; 2. Energy Service Company (ESCO) Promotion Program; 3. Loan Portfolio Design Program; 4. Demand-Side Management (DSM) Technical Assistance Program;5. Information Dissemination, Training, and Commodity Procurement Program. In early 1997, standards and labeling component was added to EMCAT.

STANDARDS AND LABELING IN A GLOBAL PERSPECTIVE

In India, where generation capacities lag far behind fast-rising demand for electric power, energy efficiency improvements can slow the growth in energy consumption and additional capacity requirements, thereby producing economic and environmental benefits. Energy efficiency standards and labeling programs are one class of energy policies that are absolutely necessary to overcome these barriers, and have been adopted in industrialized countries and few developing countries.

International Experience

Several industrialized countries and few developing countries have employed the concept of establishing energy efficiency standards and instituting labeling mechanisms to facilitate the development of a market for energy efficient appliances and equipment during the past two decades. Nine countries have minimum energy efficiency standards for household appliances *[6]*. The US and Canada have the most followed by Switzerland and China. The standards in all countries except Switzerland and Japan are mandatory. In the US, standards have been used first at the state, and then at the federal , level to reduce energy use and consumer energy bills *[12, 13]*. In Australia also, labeling scheme began in the New South wales and Victoria, followed by one at the federal level *[18]*. It is important to note that both in the US and in Australia, standards and labeling started getting legislated very recently -- beginning around 1987 *[10, 18]*.

At least 11 countries and the European Union have energy labeling programs, mostly comparative type and mandatory. In the US, there are six labeling programs, two mandatory comparison programs (Energy Guide and Auto Fuel Economy, since 1970s), two voluntary comparison programs (NFRC and SCS) , and two voluntary endorsement programs (Energy Star and Green Seal). Appliances covered by energy standards include: refrigerators/ refrigerators-freezers/ freezers, room air-conditioners, central air-conditioners and central air-conditioning heat pumps, water heaters, furnaces, direct heating equipment, fluorescent lamp ballasts, clothes dryers, clothes washers, dishwashers, kitchen ranges and ovens, pool heaters, and television sets *[10]*. The National Appliance Energy Conservation Act of 1987 that established federal standards for these appliances in the U.S. allow for a schedule of possible updates that is necessary to keep track of technological developments. Incandescent and fluorescent lamps, small electric motors, office equipment and plumbing products were added to the list by the Energy Policy Act of 1992 *[3]*.

Benefits of Standards and Labeling

Appliance standards have beneficial economic and environmental effects. In the U.S., the projected economic effects of standards to date include national economy benefits of about $1,000 for every federal dollar expended on this program, and consumer benefit-cost ratio of 2.5 *[3]*. The appliance standards under the Energy Policy Act of 1992 for the residential sector alone are projected to generate $60 billion in net present value consumer benefits by the year 2030. As a result of standards now under development, by 2015, the US electricity needs will be reduced by 75,000 MW and will result in net consumer benefits of $140 billion. At present energy prices, the annual energy savings in 2015 will total approximately $250 per household.

Evidence shows that energy efficiency standards and labeling programs have brought considerable benefits in the industrialized world. A recent study *[6]* projected avoided capacity addition of 25 Gigawatts and cumulative energy savings of over 1.6 million Gigawatt-hours by 2020 from the establishment of appropriate energy efficiency standards in India.

EVALUATION OF ENERGY EFFICIENCY STANDARDS AND LABELING IN INDIA

Standards for energy efficiency in India have been weak compared to international standards, for most energy-consuming appliances and equipment. In addition to the barriers listed in the foregoing discussion, there are constraints specific to the standards and labeling policies.

Institutional Framework and Process

Bureau of Indian Standards (BIS) is the only administrative body with a mandate to establish mandatory standards, but it does not have the authority to initiate stronger standards. Nor does BIS have the institutional infrastructure to operate a voluntary labeling program *[2]*. The role of BIS in the field of energy conservation is basically catalytic.

There are several institutional barriers. The Coordination Cell for Energy Conservation in the BIS reviews energy conservation aspects of the standards and oversees the work of 350 committees that review and formulate standards bearing on energy use *[15]*. Standards are set or revised by a consensus approach within the BIS, by these committees that are involved with criteria development for each product. BIS simply acts on the recommendations of these committees. These committees include government officials from the BIS, Ministry of Civil Supplies (and sometimes,

from the Ministry of Environment and Forests) but are largely dominated by members from the manufacturing sector. Consumer groups are rarely represented in these committees. As a result, standards are set or revised according to the assessment of the manufacturers and what they think are appropriate rather than on an assessment based on what could be achieved based on a comparative analysis of domestic and best available technologies. There is little incentive for the manufacturers to propose something new that is more extensive to produce and that would entail higher risk of reducing market share. The dealer/retailer which is the closest point on the distribution chain to the consumer can influence purchase decision of consumers. But a recent survey *[11]* observed that dealers/ retailers are not even aware about energy efficiency of appliances and detailed information is not available with them. In a nutshell, the process of establishing standards itself (including energy efficiency standards) in India is in itself detrimental to the objective of energy efficiency improvements.

Even in the U.S., the process of developing standards has evolved since the 1970s, with increasing participation by manufacturers and other interested parties in the early stages of the analysis of standards updates. But, this process has been complemented by various legislations at the state and federal level. At the federal level, Acts were legislated in 1978, 1987, and 1992 in the U.S. In India also, there is a need for some similar energy efficiency-related legislation at national level to make these policies effective.

Status of Energy Efficiency Standards

BIS, under the Ministry of Civil Supplies, has formulated over 15,000 standards, of which only 200 address energy efficiency. Most of the BIS standards deal with quality, safety and performance issues.

The BIS standards are largely voluntary. The energy efficiency component of BIS standards are not strong as compared with the highest energy efficiencies of products available internationally, or even in the Indian market. In addition, there exists substantial technical potential to improve energy efficiency of appliances manufactured in India. For example, field studies indicate that domestically manufactured refrigerators consume 20-40% more energy in India than in developed countries *[22]*.

Most Indian standards related to energy conservation are based on either maximum consumption, maximum losses or minimum efficiency *[2]*. These standards are ineffectual as they are largely voluntary and often lagging behind the energy performance of products available in the market. For instance, a 2.0 kWh/day energy consumption standard for 165 liter refrigerators, until recently, was met by virtually all models produced in the formal manufacturing sector. The concerns about this apparent disparity finally led to revision to 1.25 kWh/day only very recently. But, this efficiency level too is below some of the best refrigerators available in India and would, thus, not have much effect on pulling up the market for efficient refrigerators. According to personal communication with Tata Energy Research Institute (TERI), a 1.0 kWh/day standard for 165-liter refrigerators could also be met by many manufacturers just by improving the refrigerator insulation. The international standard is 0.65 kWh per day for similar size refrigerators.

Energy Efficiency Labeling

To enable consumers to make purchase decisions based on energy efficiency characteristics, reliable comparative information on savings should be available. Large industries and commercial consumers generally have in-house technical know-how available regarding the equipment they purchase. But, at present, such information is not readily available for residential consumers that make purchasing decisions for appliances *[18]*. In the absence of a rational and effective energy efficiency labeling scheme, manufacturers have little incentive to give priority to energy efficiency improvement of appliances. On the other hand, consumers are also not fully aware of energy efficiency levels of different brands and cannot factor in this criteria toward making their purchasing decisions.

Energy efficiency labeling is virtually non-existent in India. The simple endorsement-type labeling system for appliances applied by BIS for certifying the product brands that meet the BIS standards do not have specific information regarding the energy efficiency of appliances. The existing BIS label is a simple metal piece, marked with the BIS logo and relevant Standard reference, that is usually fixed beneath the appliance *[16]*. Marking of energy consumption on the name plate of equipment is prevalent *[2]* for electric motors, household electrical appliances, lamps and refrigerators, but it does not give enough information to influence purchase decision of the consumers.

The Government of India had launched the voluntary "Ecomark" Scheme in 1991 for easy identification of "environment-friendly" products. Under this system, only manufacturers with full testing facilities of their own could use a Ecomark label if their product had a 5 percent improvement in energy efficiency or 5 percent reduction in energy consumption over and above the limit prescribed in

the Indian Standards.

Testing Facilities

BIS has only one laboratory of their own that is capable of testing a wide range of products for safety and quality. They also have a panel of other laboratories (some in universities and Institutes of Technology) that does the testing and certification of products on their behalf. Existing laboratories are also inadequate. For instance, room calorimeters required for determining maximum power consumption for air conditioners for 24 hours are not available *[2]*. There are other non-governmental testing groups like Consumer Education and Research Center (CERC) that do the testing from consumers perspective.

Barriers to Standards and Labeling

As the foregoing discussion reveals, the barriers to strengthening standards and labeling in India are due to manufacturer opposition and inadequate testing facilities, in addition to other barriers prevalent in the Indian energy efficiency industry. Existence of a large unorganized sector that is difficult to influence and control is also a major barrier to implementation of standards and labeling policies. A recent survey *[11]* estimated that manufacture of almost half of total air conditioners and 40% all water heaters is in the unorganized sector. Due to the absence of labeling, there is an informational barrier also that leads to less consumer awareness and lower market pull for efficient products. Indigenous manufacturers in the organized sector are interested in initiating R&D efforts to improve energy efficiency but lack adequate finance and advanced technology. Table 3 presents technological barriers in enhancing energy efficiency of some specific appliances that were identified in a recent study *[11]*. The study covers the unorganized sector also.

TABLE 3: TECHNOLOGICAL BARRIERS TO ENERGY EFFICIENCY OF SPECIFIC APPLIANCES

Appliances	*Barrier*
Air conditioners	Energy efficient scroll compressor technology is not available
Refrigerators	New frost free technology is energy intensive
Water heaters	Manufactured with old technology, only insulation material has been changed
Fluorescent lamps	Energy efficient tri-band phosphor for coating is very expensive; 36 watt tube light manufacturing technology not available with most manufacturers; High cost of R&D efforts

Source: *[11]*

Recent Developments in Standards and Labeling Area

In a recent development in this area, a workshop on standards and labeling was organized by EMC in New Delhi in March 1997. The purpose of this workshop was to solicit input from manufacturers about beginning a voluntary labeling program for various appliances and equipment. EMC contracted Kirloskar Consultants Limited (KCL), Pune, to help identify opportunities for setting new, and improving existing, energy efficiency standards, and establishing labeling programs. The objective of the workshop was to convene a group of manufacturers and policy makers to discuss KCL's recommendations *[11]*. RMA's proposed activities are complimentary to the framework that emerged at this workshop. The participants at the workshop agreed that initiating a voluntary labeling program is a good first step toward developing a full-fledged labeling system in India, similar to that in the US and other industrialized countries. This would also help the policy makers --BIS and EMC -- to understand the pitfalls of the system before the standards could be made mandatory. In the US also, appliance standards were established in phases. The standards adopted in 1970s in California and other states, in fact, laid the groundwork for adoption of federal standards in late 1980s and early 1990s *[6]*.

The programs should begin with a focus on refrigerators, air conditioners and hot water heaters (geysers) which have the maximum potential for improvements. Although electricity consumption by fans (air coolers) have the highest share *[1]* it would be difficult to implement a standards and labeling system in this area because a considerable portion of fan manufacturing is in the unorganized sector. These three recommended categories of appliances and lighting accounts for about 60% of residential energy consumption. Consumption of these appliances is increasing rapidly due to population growth, urbanization, increasing size of the Indian middle classes, and the availability of imported appliances in the Indian market. For instance, between 1975 and 1987, the number of air-conditioners and refrigerators have increased 4-fold and 6-fold respectively *[1]*. And, the trend continues at a much faster rate during this decade. The current market size of air conditioners and refrigerators is Rs. 10 billion is expected to be doubled by 2000 *[11]*. The market for lamps is over Rs. 18 billion per year.

Residential lighting, is an important area to focus for energy policy development. However, unlike the US and other industrialized countries, a considerable share of lighting appliance manufacturing is in the unorganized sector. Furthermore, there are many manufactured brands and the difference in energy performance between brands is believed to be insignificant. Also, a comparison of incandescent to

fluorescent (or to a compact fluorescent) lamp is difficult due to the difference in cost and performance and an appropriate comparative type of label that would be simple enough for customers to understand would be relatively difficult to develop.

FUTURE PROSPECTS AND ACTIVITIES

A draft plan has been prepared by EMC for formulation of a system of standards and introduction of labeling system at the federal level. The need for further comprehensive studies and research to find out the effectiveness of different kinds of labels is felt however. The need to assess testing facilities and future requirements to make this effort sustainable and successful also requires to be highlighted.

Priority Areas

The focus of introduction of standards should be at a place where subsidies on electricity prices are the least or non-existent, according to RMA *[16]*. It has been suggested by many local energy experts that the environmental benefits of energy efficient equipment should also be incorporated in these labels. This will be appealing particularly to the group of educated consumers that generally uses the energy intensive residential appliances, like air-conditioners, refrigerators, and storage water heaters. Also, as in case of Ecomark Scheme discussed in an earlier section, it is clear that such a balance between energy and environmental objectives is possible while formulating the standards and labeling policies.

The need for providing incentives to manufacturers to adopt voluntary labeling needs further investigation. Manufacturers of efficient equipment may readily accept the labeling system without any incentives as these would benefit them. Based on the evidence from other developing countries like Thailand and the Philippines, it can be expected that when consumers consider these labels and prefer buying efficient equipment, that would stimulate the market for more efficient appliances. This would in turn result in the less efficient appliance manufacturers to improve their stock to meet that higher demand for efficient equipment, as well as to remain competitive. It is the dis-incentive of losing the share in the market that would encourage less efficient equipment manufacturers to produce better equipment. Thus the voluntary labeling itself will become a trigger for these manufacturers to take necessary actions to be able to remain in the market by producing better equipment.

Institutional and Infrastructural Issues

In India, top-of-the-line manufacturers have often requested labeling programs in the past because they believe them to be a effective marketing tool. However, they are in the minority in the product committees of BIS. So, the standards making process itself needs to be addressed and reformed. Also, the need for an institutional setup for standards and labeling framework that provides incentives to regularly upgrade standards to reflect current manufacturing trends cannot be overemphasized. A program of periodic upgradation of energy efficiency limits at BIS occurs only in the case of oil stoves, domestic LPG stoves and diesel engines, and more recently, in occurred in case of refrigerators [2].

EMC, the energy efficiency arm of the Ministry of Power, is quite interested in strengthening the minimum efficiency . BIS is also enthusiastic about energy efficiency standards although they usually act upon the recommendations that are developed by product committees, and energy efficiency is just one component of a large mandate. BIS officials however feel that the labeling scheme should integrate safety issues with energy efficiency aspects. Consumer organizations (CERC, etc.) should spread awareness of energy efficiency among their members.

Future Tasks and Potential

A recent study *[6]* estimated a potential energy savings of 173, 105, 28, and 307 TWh from standards for refrigerators, air-conditioners, water heaters and industrial motors respectively within the period 2000-20, comprising over one-third of all sector energy savings possible during that period. Lighting energy efficiency standards could save about 135 TWH. Table 4 shows estimated potential for energy savings for some appliances determined by another study *[11]*.

TABLE 4: ESTIMATED ENERGY SAVINGS POTENTIAL FOR SPECIFIC APPLIANCES

Appliances	*Annual Production (million)*	*Lowest kW*	*Highest kW*	*Savings Potential (GWh)*
Air conditioner (1.5 T model)	0.35	1.08	2.10	0.321
Refrigerator (165-liter)	2.25	0.105	0.120	0.405
Fluorescent lamp	128.0	0.046	0.055	6.220
CFL (5% / GLS)	20	0.020	0.100	8.000
Fans (Ceiling & Table)	10.5	0.055	0.080	1.417

Source: *[11]*

Target areas need to be selected carefully for introduction of labeling programs. Four product areas have been tentatively selected by RMA for the program design -- refrigerators, air-conditioners, water heaters, and motors. Motors were added because of its importance in the Indian energy sector due to the large share (over 65%) of industrial electricity consumption.

Program Design and Implementation

A framework of program design is being prepared that will lay out a recommended action plan for establishing and implementing a system of stronger energy efficiency standards and establishing voluntary labeling scheme. The program review would also consider the effectiveness (advantages/disadvantages) of alternative system of labels (Comparative type based on Star vs. Color Vs. Number rating or Endorsement type) and what type of information on the labels (Annual kWh consumption Vs. Annual Operating Cost Vs. Life-cycle Cost Vs. Environmental Benefits' Indicators or a combination) would most effectively influence consumer behavior taking into account the informational, cultural, and institutional barriers. Since, the endorsement type of labels have not been effective in influencing purchase decisions by residential consumers in India, it appears that a comparison-type should be be more effective. However, this matter needs further investigation. In Australia, for instance, understanding of energy labeling by consumers took several years *[18]*.

Labels for energy efficiency should be easy to understand by the consumers who will make purchase decisions. While designing the labeling system however, the interests of local institutions have to be addressed. EMC has proposed designing a label that would have safety, energy consumption, and environmental performance. The safety issue was stressed by BIS, but combining all this into one label will complicate the issue. The labels should be simple enough to be easily understood by users. Also, the local conditions should be kept in mind. For instance, one of the problems with the Star system for grading an appliance, that is in existence in Australia *[18]*, could be the conflict with the already existing system using stars to indicate temperature levels for refrigerators.

CONCLUDING REMARKS

This paper builds a compelling case for aggressive energy policy reform to promote electricity end-use efficiency improvement through strengthening of standards and introduction of an effective labeling mechanism for energy efficiency in India.

There is an enormous scope for energy conservation in developing countries like India. Removal of market barriers prevalent in such countries is an essential precursor to furthering the cause of end-use energy efficiency improvements. Standards and labeling mechanisms facilitate the implementation of energy efficiency policies by creating the availability and supply of energy efficient appliances as well as by generating an increased consumer demand for such better appliances in the market. The effectiveness of such policies, however, depends on many factors and features that are necessary to overcoming these barriers, specific to each country. In India, for instance, some of the major constraints include the existence of a substantial unorganized sector for appliance manufacturing, an inadequate testing infrastructure, and an ineffectual institutional framework.

Under the EMCAT project, a development effort funded by the USAID in India, an initiative has been launched recently by Resource Management Associates of Madison, Inc., USAID's primary energy efficiency contractor under EMCAT, to assist the local institutions in this area. As described in the foregoing sections, the project aims to strengthen the existing status of energy efficiency standards and create a framework for the introduction of effective labeling mechanisms that would induce customer purchase of efficient appliances. The objective of these activities is to facilitate the market transformation toward higher energy efficiency, and to utilize the enormous potential for electrical energy conservation, primarily in the residential sector, in meeting India's electricity needs over the next few decades.

Remarkable evidence from other countries and preliminary experience in this project show that the potential for reducing overall energy consumption can be achieved through application of cost-effective end-use technologies, the market of which is expected to develop as a result of effective implementation of standards and labeling policies. The experience with the EMCAT energy efficiency standards and labeling project may well pave the way for an energy efficiency revolution in India's electricity industry, an arena that has enormous potential for end-use energy efficiency improvements.

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Note: RMA in-house working papers, and information obtained through personal communication with several individuals in India, have been used in the development of this article; they are, however, not included in the bibliography.

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ENERGY EFFICIENCY STANDARDS AND LABELING IN INDIA:

An Evaluation of Status, Barriers, and Potential

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Ahmedabad, India
August 29, 1997

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ELEMENTS OF ENERGY EFFICIENCY PROJECTS AND DEMAND-SIDE PROGRAMS

- Objective is to Continously Improve the Stock of End-Use Appliances and Equipments in a Self-Sustaining Manner

- Motivate Active Participation by All the Stakeholders that have a Role to Play in Attaining this Objective:

  -- Consumers
  -- Appliance manufacturers (and dealers, retailers)
  -- Energy suppliers (electric utilities)
  -- Government entities
  -- Non-government agencies

PROCESS OF ENERGY EFFICIENCY DEVELOPMENT

- Begin with "Command-and-Control" based development (Government support necessary, to overcome market barriers; support in the form of incentives, etc)

- End up with "Market-Driven" development (Government intervention decreases, market barriers are removed, and manufacturers and consumers make rational "market based" decisions)

- Transition is facilitated by energy efficiency improvement programs (such as US AID's EMCAT)

TOOLS TO IMPROVE ENERGY EFFICIENCY

- Technology Upgradation - Research & Development (Private Sector & Government)
- Demand Side Management -DSM (electric utilities, consumers)
- Innovative Financing (Development banks, ESCOs, etc)
- Energy Efficiency Standards (Government)
- Energy Efficiency Labels (Manufacturers, Government)
- Integrated and Multi-Pronged Approach

APPLIANCE ENERGY EFFICIENCY STANDARDS AND LABELING

- Standards in India weaker than in US, Canada, Australia (also Philippines, Thailand, etc)
- Standards do not necessarily reflect Appliance Stock available in the Market
- Endorsement Labels Exist, Do not provide energy efficiency information
- High potential of reducing energy needs
- Barriers to Energy Efficiency are prevalent
- Barriers to strenghthening standards and introducing labeling also exist

ESTIMATED ENERGY SAVINGS POTENTIAL: SPECIFIC APPLIANCES

Appliances	*Annual Production (million)*	*Lowest kW*	*Highest kW*	*Savings Potential (GWh)*
Air conditioner (1.5 T model)	0.35	1.08	2.10	0.321
Refrigerator (165-liter)	2.25	0.105	0.120	0.405
Fluorescent lamp	128.0	0.046	0.055	6.220
CFL (5% / GLS)	20	0.020	0.100	8.000
Fans (Ceiling & Table)	10.5	0.055	0.080	1.417

Source: *Kirloskar Consultants*

ROLE OF STANDARDS AND LABELING TOWARD NATIONAL ENERGY SAVINGS

Appliances	*Savings Potential 2000-2020 in Tera-watt hours*
Refrigerators **	173
Air-Conditioners **	105
Water Heaters **	28
Industrial Motors	307
Lighting Improvements	135

Courtesy: *IIEC*

** Labeling under consideration for these appliances by BIS and EMC

PRIMARY BARRIERS TO STANDARDS AND LABELING

- Tariff barriers (price do not reflect long-run marginal costs of supply)
- Existence of large unorganized maufacturing sector
- Technical barriers (high cost of R&D, lack of availability)
- Standard-setting process
- Lack of Consumer Awareness and Research (no participation of consumer groups)
- Inadequate testing facilities

TECHNOLOGICAL BARRIERS TO ENERGY EFFICIENCY IMPROVEMENT: SPECIFIC APPLIANCES

Appliances	*Barrier*
Air conditioners	Energy efficient scroll compressor technology is not available
Refrigerators	New frost free technology is energy intensive
Water heaters	Manufactured with old technology, only insulation material has been changed
Fluorescent lamps	Energy efficient tri-band phosphor for coating is very expensive; 36 watt tube light manufacturing technology not available with most manufacturers; High cost of R&D efforts

Source: *Kirloskar Consultants*

ENERGY EFFICIENCY LABELING MECHANISMS

- PHILOSOPHY: **"Market Pull"** Versus **"Market Push"**
  Policy Driven By: *Manufacturer* *Consumer*

- SYSTEM: **Voluntary** Versus **Mandatory**

- TYPE:
  - -- Endorsement (target top 15-20%)
  - -- Comparison (numbers, stars, scales, grades)
  - -- Detailed (consumption, efficiency, oper. costs)

- INFORMATION:
  - -- Energy Consumption
  - -- Energy Costs (Yearly)
  - -- Lifecycle Costs
  - -- Environmental Costs

COST-BENEFIT ANALYSIS OF RESIDENTIAL APPLIANCES

Example: Refrigerator 165 liter model (Top-Mount Freezer)

From 1.25 kWh/day to 1.00 kWh/day

- Difference in Upfront **Cost** to Consumer: Rs. 1000
- Difference in Life-Cycle **Net Benefits** to Consumer: Rs. 392
- Net Benefits to the Electric Utility Per Refrigerator: Rs. 255
- Environmental Benefits to Society: Rs. 332

ELEMENTS OF SUCCESS IN A STANDARDS AND LABELING PROGRAM

- Consumer awareness (through media, salesperson training, etc)
- Adequate testing facilities (Federal labs, Underwriter Labs, etc.)
- Manufacturer participation and support (eg., in the US)
- Upgrading Standards To Reflect Technology Availability in the Industry (like refrigerator standards in the US)
- Consumer-friendly and easy-to-understand labels (Readability Vs Accuracy)
- Integration with other energy efficiency programs (utility DSM, Green Procurement, Eco-labeling, etc)

CONSUMER RESEARCH FOR STANDARDS & LABELING POLICIES

- Do they look at the label? (only 10% in the US)
- Do they understand the labels? (50% do not understand)
- Do they use it to make a decision?
- How concerned are they about upfront costs?
- Are they environmentally concerned?
- Do they calculate payback (50%)
- What info they value more: kWh? Operating Rupees? Life-Cycle Rupees?

STRATEGY OPTIONS FOR THE FUTURE

- Increase Consumer Awareness of Energy Efficiency (EMC...)
- Rational Electricity Tariffs (Utilities, Goverment, Regulatory Bodies)
- Establish Stronger Standards (BIS, Manufacturers)
- Conduct Consumer Research (CERC...)
- Improve Energy Efficiency Testing Facilities (CERC, UL affiliates,...)
- Introduce Voluntary Labeling of Major End-Use Appliances (BIS, TERI,...)
- Move Toward Mandatory Labeling (BIS)

APPENDIX V
NEB's Tariff Structure

AMENDMENT.

In the said Act, for the Schedule, the following schedule shall be substituted, namely:—

THE SCHEDULE

(*See* section 3.)

PART-A.

HIGH TENSION SUPPLY

High Tension Tariff I:

Registered factories, tea estates, textiles, railway tractions, fertilizers, Salem Steel Plant, Heavy Water Plant, Caustic Soda, Calcium, Cabide, Aluminium and Potassium Chlorate and all other industrial establishments.

Area	Rate per KWH.	Rate per KVA of maximum demand per month.
(1)	(2)	(3)
	(in Paise.)	(in Rupees.)
Chennai Metropolitan	290	125
Non-Metropolitan	280	125

(a) New High Tension Industries set up in any area on or after 15th February 1997 shall not be eligible for any tariff concession:

Provided that the High Tension Industries set up in any area other than Chennai Metropolitan area before 15th February 1997 shall continue to avail themselves of the said tariff concession until the expiry of the period of three years from the date on which the consumer is given service connection.

(b) New Industry to be set up in the areas other than the Chennai Metropolitan areas which will work night shift only and existing industry, which has only night shift between 9.30 p.m. of a day and 5.30 a.m. of the next day, shall be given a concession of 40 per cent of the appropriate rate for energy consumers during night shift only for a period of seven months from July to January during a period of five years from the date of giving service connection. This concession shall apply to energy rate arrived at after giving the concession if any:

Provided that in respect of those having one day shift and one night shift, the night shift concession shall stand reduce from 40 per cent to 20 per cent.

Explanation.—For the purpose of this clause "Existing Industry" means an industry which has not completed five years from the date, the consumer is given service connection on and which is still eligible to the concessional tariff rate.

(c) (i) If a consumer availing himself of High Tension Supply under this tariff does not for any reason utilise the power load for more than thirty days, then the energy utilised in the service for lighting and non-industrial purposes shall be billed under High Tension Tariff III.

(ii) In the case of supply under High Tension Tariff I the use of electricity for bonafide purposes of lighting, heating and power loads in the residential quarters within the factory or in the estate premises shall be metered separately by the consumer taking High Tension Supply and paid for to the Board at Low Tension Tariff I. The units so metered shall be deducted from the total number of units registered in the main meter of the High Tension Supply for billing purposes.

(d) For the High Tension Industrial consumers, Time of the day meter shall be provided. On installation of Time of the Day meters the High Tension Industrial consumers shall be billed at 20 per cent extra on the energy charges for the energy recorded during peak load hours. The duration of peak load hours shall be as under:—

1. 6.00 a.m. to 9.00 a.m.
2. 6.00 p.m. to 9.00 p.m.

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High Tension Tariff-II.

Recognised educational institutions, hostels run by recognised educational institutions, Government Hospitals, Hospitals under the control of Panchayat Unions, Municipalities or Corporations, Veterinary hospitals, Leprosy sub-Centres, Primary Health Centres, Health Sub Centres, actual Places of Public Workship, Orphanages, Public Libraries, Water Works Public Lighting Public sewerage works by Government / Local bodies, Laboratories, Research Institutions, Studios, Cinema Theatres and such other Institutions declared by the Government from time to time.

Area.	Rate per KWH.	Rate per KVA of maximum demand per month.
(1)	(2)	(3)
	(in paise.)	(in rupees.)
Chennai Metropolitan	220	100
Non-Metropolitan	210	100

In the case of supply under High Tension Tariff-II the usage of electricity for bonafide purposes of lighting, heating and power loads in the residential quarters within the factory or in the estate premises shall be metered separately by the consumer, taking high Tension Supply and paid for to the Board at Low Tension Tariff I A. The units so metered shall be deducted from the total number of units registered in the main meter of the High Tension Supply for billing purposes.

High Tension Tariff-III:

(i) Commercial and all categories of consumers not covered under High Tension Tariff I, II, IV, and V.

Area.	Rate per KWH.	Rate per KVA of maximum demand per month.
(1)	(2)	(3)
	(in paise.)	(in rupees.)
Chennai Metropolitan	300	150
Non-Metropolitan	290	150

Provided that the industries requiring High Tension Supply during construction period shall be charged under this tariff.

(ii) In the case of supply under High Tension Tariff III, the usage of electricity for bonafide purposes of lighting, heating and power loads in the residential quarters within the factory or in the estate premises shall be metered separately by the consumer, taking High Tension Supply and paid for to the Board at Low Tension Tariff IA. The units so metered shall be deducted from the total number of units registered in the main meter of the High Tension Supply for billing purposes.

New Tourism projects set up in any area on or after 15th February 1997 shall not be eligible for any tariff concession:

Provided that the New Tourism Projects set up before 15th February 1997 and availing themselves tariff concession shall continue to avail themselves the said tariff concession until the expiry of the period of three years from the date of the consumer is given service connection on.

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High Tension Tariff IV :

	Rate per KWH (in Paise)
Lift Irrigation Co-operative Societies for Agriculture	25

Explanation.—The Lift Irrigation Co-operative Societies for Agriculture may be registered with Registrar of Co-operative Societies or under any other Act.

High Tension Tariff V :

Supply to Pondicherry State shall be at the Thermal Station I rate charged by the Neyveli Lignite Corporation to the Tamil Nadu Electricity Board plus wheeling charge at 10 paise per KWH plus 4 per cent on the energy wheeled towards transmission loss.

General provisions applicable to consumers covered under High Tension Tariffs I to V :

(i) Any High Tension Supply involving a sanctioned demand above 5000 KVA plus 2 per cent marginal adjustment shall be given supply only at 33 KV, if available in the area or at EST Voltage :

(ii) Time limit to avail of supply at 33 KV or EHT Voltage :

(a) Category I—Existing High Tension Consumers, whose sanctioned demand exceeds 5,000 KVA have been given time upto 31st August 1985 to avail themselves of supply at the voltage indicated in item (i) above.

(b) Category II—Existing High Tension Consumers whose sanction3d demand is 5,000 KVA or less and who require additional demand by which the total sanctioned demand would exceed 5000 KVA shall be given the additional demand only after they are ready to avail the supply at the voltage indicated in item (i) above.

(c) Category III—New High Tension Consumers requesting supply for a demand above 5000 KVA shall be given supply only at the voltage indicated in item (i) above.

(iii) Extra Levy (a) Category I.—In the case of existing High Tension Consumers whose sanctioned demand exceeds 5000 KVA and who do not avail themselves of supply at the voltage indicated in item (i) within the stipulated period they shall be charged an extra levy of ten paise per KWH over and above the normal tariff, for the entire energy consumed.

(b) Category II.—The existing High Tension Consumers whose sanctioned demand, with the additional deemand sanctioned exceeds 5,000 KVA may be with the approval of the Board be allowed the additional demand at the High Tension supply itself for a period not exceeding 12 months from the date of sanction of the additional demand. Provided they agree to be charged the extra levy of ten paise per KWH. Over and above the normal tariff for the entire energy consumed till they avail themselves of the supply at 33 KV or at EHT voltage as may be applicable.

(iv) Power Factor/Low Factor surcharge.—

In respect of High Tension service connections, the average power factor of the consumers installation shall not be less than 0.90 lag. There the average power factor of High Tension service connection is less than the stipulated limit of 0.90 lag, the following compensation charges will be levied :—

0.90 lag and below and upto 0.85	1 per cent of the current consumption charges for every reduction of 0.01 in power factor.
Below 0.85 to 0.75	One and half per cent current consumption charges for every reduction of 0.01 in power factor from 0.90.
Below 0.75	2 per cent of the current consumption charges for every reduction of 0.01 in power factor from 0.90.

Current consumption charges include the charges of recorded demand and the energy charges at notified tariff rate excluding concessions, if any.

(v) Billable Demand.—

The Maximum Demand charges for any month and at the point of supply shall be based on the KVA demand recorded in that month or 100 per cent of the sanctioned demand whichever is higher.

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PART B.

LOW TENSION SUPPLY

Low Tension Tariff I-A :

Domestic purposes for lights and fans including radios and power loads—

1. Fixed Charges—

(i) For consumption upto 50 KWH per month/ 100 KWH for two months..	No fixed charges.
(ii) Others ..	Rs. 5 per service per month or Rs. 10 per service for two months.

PLUS

2. Energy Charges :

(a) For consumption upto 25 KWH per month/ 50 KWH for two months	65 paise per KWH.
(b) For consumption from 26 KWH to 50 KWH per month/ 51 KWH to 100 KWH for two months. ..	80 paise per KWH.
(c) For Consumption from 51 KWH to 100 KWH per month/ 101 KWH to 200 KWH for two months ..	120 paise per KWH.
(d) For consumption from 101 KWH to 300 KWH per month/ 201 KWH to 600 KWH for two months ..	180 paise per KWH.
(e) For consumption of 301 KWH and above per month/ 601 KWH and above for two months ..	250 paise per KWH.
Minimum monthly charges ..	Rs. 10 per service.

This tariff is restricted to services which are exclusively domestic and to the following services :—

(i) Handlooms in residence of handloom weavers (regardless of the fact whether outside labour is employed or not) and to handlooms in sheds erected where energy is availed of only for lighting purposes.

(ii) Public conveniences maintained and run by local bodies and by such other organisations as are specified by the Government from time to time.

(iii) Community Nutrition Centres and Block Officers of Tamil Nadu Integrated Nutrition Project.

(iv) Anganwadi Centres, Nutritious Meals Centres and School Buildings associated with the Government Welfare Schemes.

LOW TENSION TARIFF II/B :

Huts in village panchayats, houses constructed under Jawahar Velai Vaipu Thittam, TAHDCO and Kamarajar Adi-Dravidar Housing Scheme and huts in Town Panchayats in Kanniyakumari District alone—No Charge.

EXPLANATION I.—Hut means a living place not exceeding 200 square feet area with mud wall and thatched roof.

EXPLANATION II.—Only one light not exceeding 40 watts shall be permitted per hut.

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LOW TENSION TARIFF II—A :

Public Lighting and Public Water-Supply System:-

Area.	Energy charges.
(1)	(2)
Public Lighting and Public Water Supply System in Village Panchayats, Town Panchayats and Township Areas.	160 Paise Per KWH
Public Lighting and Public Water-Supply System in Municipalities and Municipal Corporation Areas.	175 Paise per KWH
Minimum monthly charges	Rs. 20 per service

LOW TENSION TARIFF II—B

Recognised educational Institutions, Hostels run by recognised Educational Institutions, Hostels run by Adi Dravidar and Tribal Welfare and Backward Class Welfare Department, Government Hospitals, Hospital under the control of the Panchayat Unions Municipalties or Corporation, Veterinery Hospitals Leprasy sub-Centres, Primary Health Centres, Healt sub-centres, Laboratories, Research Institutiues, Studios, Cinemas, Theatres, actual Places Public Worship, Orphanages, Public Libraries Homes for Destitute and Old People, Flood lighting arrangements in the Rock Fort Temple, its environs and the roads and pathways leading to the Temple at Tiruchiprappalli and such other institutions declared by the Government.

1. Fixed charges — Rs. 10 per service per month or Rs. 20 per service for two months.

PLUS

2. Energey chargs

Area.	Rate per KWH. (in paise)
(1)	(2)
Chennai Motropolitan areas.	250
Non-Metropolitan areas.	240
Minimum monthly charges	Rs. 20 per service.

LOW TENSION TARIFF III—A :

Cottage and Tiny Industries, Small Gem Cutting units where Cutting operation is done with or without Powerlooms and Seri-culture :—

1. Fixed charges — Rs. 30 per service per month or Rs. 60 per service for two months

PLUS

2. Energy charges :—

(a) For consumption upto 250 KWH per month/upto 500 KWH for two months.	130 paise per KWH
(b) For consumption from 251 KWH to 750 KWH per month/from 501 KWH to 1500 KWH for two months.	210 paise per KWH
(c) For consumption of 751 KWH and above per month 1501 KWH and above for 2 months.	240 paise per KWH.
Minimum monthly charges	Rs. 30 per service.

Provided that the connected load shall not exceed 10 Horse Power.

Supply to welding sets will be charged under Low Tension Tariff III—B.

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LOW TENSION TARIFF III—B

Coffee grinding, Ice Factory, Body Building Unit Saw Mill, Rice Mill, Flour Mill, Prawn Farming, Poultry Farming Battery Charging Unit and Industries not covered under Low Tension Tariff IIIA :—

1. Fixed charges .. Rs. 30 per service per month or Rs. 60 per service for two months.

PLUS

2. Enery charges

	Chennai Metropolitan Areas. (1)	Non-Metropolitan Areas. (2)
	Paise/KWH	Paise/KWH
(a) Rate for the consumption on the first 750 KWH per month or 1,500 KWH for two months.	280	270
(b) Rate for the consumption in excess over 750 KWH per month or 1,500 KWH for two months.	330	320

Minimum monthly charges Rs. 40 per KW or part thereof of contracted load.

EXPLANATION I : For supply to welding sets this rate will be increased by 25 per cent.

EXPLANATION II : The connected load under lighting and other non industrial purposes connected with the Factory within the factory premises shall not exceed 15 per cent of that for power and heating. Where the Lighting and non-industrial load exceeds the permissible limit of 15 per cent, the whole service shall be brought under low Tension Tariff V.

Alternative :

Industrial installation having connected load 75 KVA and above but not exceeding 150 KVA.

Demand charges .. Rs. 125 per KVA per month

PLUS

Energy charges :

Madras Metropolitan — 290 paise per KWH

Non-Metropolitan .. 280 paise per KWH

The provision of Low Tension Trivector meter and the above two part tariff rate is at the option of the consumer with all other stipulations prescribed for the High Tension consumers.

LOW TENSION TARIFF IV :

Agriculture No charge

Provided that for the agriculturists having power connection for their pumpsets by payment of Rs. 10,000 (Rupees Ten thousand only) or the actual cost of extension of power connection, as the case may be, the rate of tariff shall be Rs. 250 (Rupees Two hundred and fifty only) per Horse Power per annum or metered tariff at the rate of fifty paise per KWH, at the option of the consumer.

EXPLANATION I : (a) Agriculturists shall be permitted lighting upto 50 watts per 1000 waters of motive power connected subject to a maximum of 150 watts inclusive of wattage of pilot lamps each of which shall not exceed 15 watts and with not more than 3 lamps (excluding pilot lamps) for lighting the farm or the field around the pumsets. Energy used for radios or other appliances including domestic appliances in the farm houses shall be metered separately and charged for at the appropriate tariff.

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(b) Agriculturists shall be permitted to use the water pumped from the well and stored in overhead tank for bonafide domestic purposes in the farm house. The farm house shall be in close proximity not exceeding 150 ft. from the well.

Explanation II.—Extra lighting in agricultural services over the permissible limit shall be charged for, at separate metered as per Low Tension Tariff V and if not separately metered a flat rate of Rs. 10 per month per 40 watts lamp (ordinary or larger wattage of lamps in proportion. If flourescent and mercury vapur lamps are connected, the flat rate shall be enhanced by 50 per cent.

Low Tension Tariff V-A.

Commercial and all categories of consumers not covered under Low Tension Tariff IA, IB, IIA, IIB, IIIA, IIIB and IV.

(1) Fixed charges. Rs. 10 per service per month or Rs. 20 per service for two months.

PLUS.

2. Energy charges.

	Chennai Metropolitan areas. (1) Rate per KWH (in paise.)	Non-Metropolitan areas. (2) Rate for KWH (in paise)
(a) Rate for the consumption upto and inclusive of 100 KWH per month or 200 KWH for two months.	330	320
(b) Rate for the consumption from 101 KWH and above per month or from 201 KWH and above for two months.	380	370

Minimum monthly charges Rs. 25 per service.

PART C.

Temporary supply.

	Rate. (1)	Minimum. (2)
(a) Lighting or combined installation of lights and fans, mixed load of lights and power exhibition motive power and heating	Rs. 5 per KWH	Rs.20 per KW per day or part thereof.
(b) Lavish illumination	Rs.10 per KWH	Rs.60 per KW per day or part thereof.

Explanation.—The rate for lavish illumination shall apply to weddings garden parties and other private functions where the illumination is obtained through bulbs fastened in outer surfaces of walls of buildings on trees and poles inside the compound and in pandals, etc outside the main building.

All other cases of illumination, obtained through bulbs fastened on outer suface of walls of buildings on trees and poles inside the compound and in pandals, etc outside the main building shall be charged as for temporary supply.

PART D.

GENERAL

The above tariffs shall be read with the general terms and conditions of supply prescribed by the Tamil Nadu Electricity Board from time to time".

SUSAN MATTHEW,
Secretary to Government.

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APPENDIX VI
Program Agenda for the August 29 AEC-RMA-USAID DSM Conference

AEC - RMA - USAID DSM CONFERENCE
DSM OPPORTUNITIES & BARRIERS IN INDIA

DATE	- 29TH AUGUST, 1997 FRIDAY
TIME	- 0900 TO 1730 HOURS
PARTICIPANTS	- FROM ELECTRIC UTILITIES / SEBS / ENERGY DEPT. OF CENTRAL / STATE GOVT. / OTHER GOVT. ORGANIZATIONS IN THE FIELD OF POWER ENERGY SERVICE COMPANIES/ ENERGY AUDITORS/ CONSULTANTS
LEVEL OF PARTICIPANTS	- HIGHER MANAGEMENT LEVEL PERSONS CONVERSANT WITH T & D AND COMMERCIAL ACTIVITIES OF POWER/ END-USERS OF ENERGY
VENUE	- AHMEDABAD, HOTEL TRIDENT - NEAR AIRPORT

0900 TO 0930 - REGISTRATION

0930 TO 1030 - **INAUGURAL SESSION**

• **WELCOME**	MR. V.M. THAKOR	G.M.(COMM), AEC	10 MIN.
• **SPEECH**	PROF. MANUBHAI SHAH	MANAGING TRUSTEE, CERC	15 MIN.
• **KEYNOTE ADDRESS**	DR. BHASKAR NATARAJAN	DIRECTOR, EMC	15 MIN.
• **INAUGURAL ADDRESS** BY CHIEF GUEST	MR. RICHARD EDWARDS	DY. DIRECTOR, USAID	15 MIN.
• **VOTE OF THANKS**	DR. ASHOK SARKAR	RMA, USA	5 MIN.

1030 TO 1050 - TEA BREAK

SESSION - I	CHAIR PERSON	- MR. J.V. MEHTA
1050 TO 1150	- DSM CONCEPTS, OPPORTUNITIES & BARRIERS	- DR HAMEED NEZHAD, RMA MR. MARK TRIBBLE, IRG
1150 TO 1250	- ROLE OF EMERGING ELECTRICITY REGULATION IN DSM IMPLEMENTATION	- DR. BHASKAR NATARAJAN, ENERGY MANAGEMENT CENTER - MR. M.I. KHUMRI, COMMI. OF ELECTRICITY(GUJARAT)
1250 TO 1350	- LUNCH	
SESSION - II	CHAIR PERSON	- DR. BHASKAR NATARAJAN
1350 TO 1510	- DSM IMPLEMENTATION ISSUES	
	AEC's EXPERIENCE	- MR. V.M. THAKOR
	ESCO - DSM FINANCE	- ASIAN ELECTRONICS
	ESCO - TOTAL ENERGY SOLUTION	- MR. R.K. IYER (SAHA SPRAGUE)
1510 TO 1600	- OVERCOMING DSM MARKET BARRIERS THROUGH ENERGY EFFICIENCY STANDARDS AND LABELING PROGRAMS	- DR. ASHOK SARKAR, RMA , USA - PROF. MANUBHAI SHAH, CERC - MR. K.B. GUPTA, ADDL. DIR., BIS
1600 TO 1615	- TEA BREAK	
SESSION - III		
1615 TO 1730	- PANEL DISCUSSION FUTURE DSM IMPLEMENTATION STRATEGIES FOR INDIA (REGULATORY, AWARENESS, MARKET AND FINANCING STRATEGIES)	- MODERATOR DR. HAMEED NEZHAD, RMA, USA

APPENDIX VII
DSM Paper and Presentation at the August 29 Conference

Paving The Way For India's Electrification Through Demand-Side Management

by
Hameed G. Nezhad, Ph.D.
Senior Energy Scientist

August 1997

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Paving The Way For India's Electrification Through Demand-Side Management

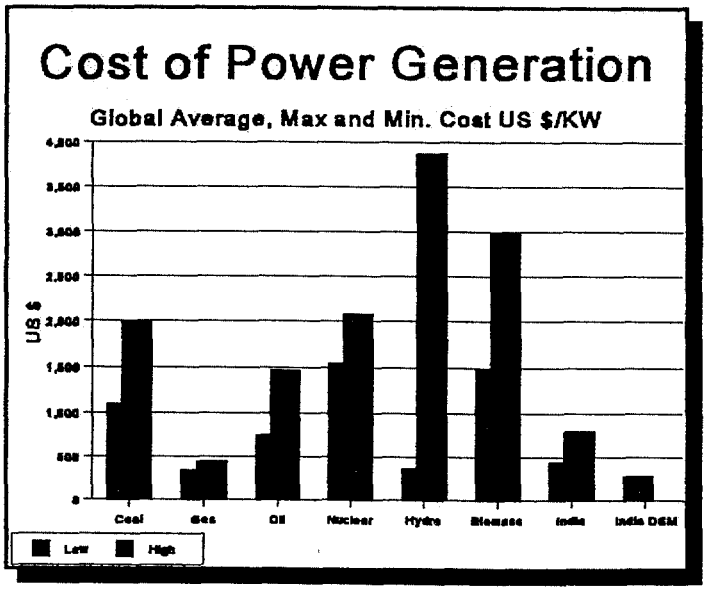
1. Why Demand-Side Management (DSM) in India?

India's electricity demand has grown at an average annual rate of 8.8 percent since 1950, when installed capacity was only 2,300 MW. (Current capacity is about 84,000 MW.) Annual capacity additions have not been able to keep up with demand, leading to power shortages and supply interruptions.

Despite the impressive growth rate of installed capacity over the past few decades, India's per capita consumption of electricity is less than 300 kWh, compared to about 500 kWh in other industrializing countries and 7,000 kWh in industrialized nations. Between 1992 and 1997, India estimated that it needed 140,000 megawatts (MW) of new electricity generation capacity. In the last five-year plan (1992-1997), though, India installed less than 60 percent of its targeted capacity. This shortfall is anticipated to increase as foreign investors continue to encounter difficulty in moving ahead with their independent power projects. Projected power needs for India are as high as 450,000 MW in 2020, when India's population is expected to reach 1.2 billion people. Additional capacities of 142,000 MW are needed within the next ten years to meet demand growth. This would entail investments on the order of US$160 billion.

India's electrification program will continue, and it will remain a strong indicator of quality of life and economic development for its people. However, considering rising costs, limited fuel supply, and shortages of capital for power plant construction, it is unlikely that projected capacity will be realized. Capacity and energy shortages result in enormous economic losses to Indian society.

In addition to the traditional supply-side improvements of reducing T&D losses and improving generation system efficiencies, the only other viable option would be to utilize available power more effectively through Demand-Side Management (DSM) — that is, intensive energy efficiency improvements and load management efforts initiated by the utilities for the mutual benefits of the utility and its customers. Potential for enormous energy savings exists in India's major industrial sectors, with estimates ranging from 8 percent to 30 percent. These savings add up to about US$ 1.5 billion per year



DSM is a cost-effective alternative to the installation of large power plants. In addition, T&D investments could also be avoided

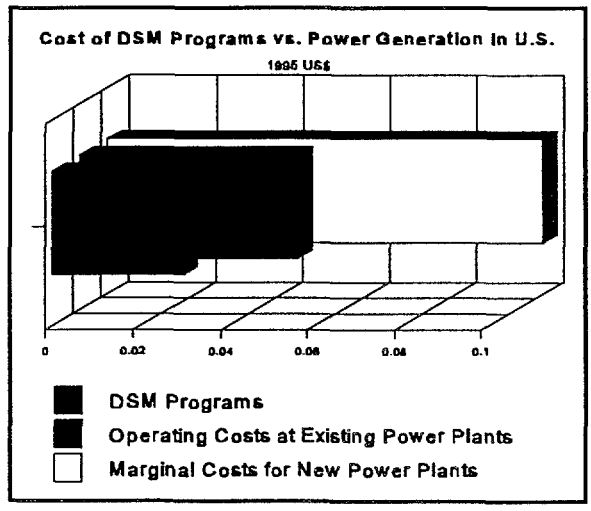
because changes take place on the customer side of the meter. DSM also helps save natural resources and curb pollution and other environmental and ecological damages.

Another important aspect of DSM that cannot be overlooked in an emerging industrialized country such as India is that investments that would have been incurred by large, expensive power projects can be channeled to other development projects, resulting in the creation of more jobs. Additionally, Indian utilities themselves would benefit from DSM by meeting increasing consumer demands at less cost.

2. What is Demand-Side Management?

Demand-Side Management (DSM) is defined as the planning, implementation, and monitoring of utility activities designed to influence customer use of electricity for the mutual benefit of the utility and the customer. DSM programs fall into two categories, energy conservation and load management. Energy conservation encourages consumers to use energy more efficiently, resulting in reduced energy consumption without sacrificing comfort, convenience, or productivity. Load management shifts electricity loads from one period to another but rarely reduces electricity consumption.

Utility DSM programs began in the United States in the late 1970s and spread to Canada, Australia, and Europe. Recently, many industrializing countries have begun to develop DSM programs. From 1991 to 1996, U.S. utilities spent more than $12 billion on DSM, resulting in an estimated peak demand reduction of 33,000 MW and energy savings of 63 billion kWh during this period.



Demand-Side Management makes sense economically, and it certainly makes sense environmentally. Many DSM programs cost substantially less per kW (or kWh) saved than it costs to generate a kWh from a new power plant. In some cases, efficiency measures cost less than the operating cost of an existing power plant.

Realizing the significant potential for DSM in India, the United States Agency for International Development and the Industrial Development Bank of India initiated a pilot project on DSM at the Ahmedabad Electricity Company (AEC) in 1994 under the Energy Management Consultation and Training (EMCAT) project. Resource Management Associates of Madison, Inc., USAID's principal energy efficiency contractor for the EMCAT project, provided technical assistance to AEC as it became the first utility in India to implement a DSM program.

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3. DSM Implementation Strategies

DSM program implementation encompasses several steps and substantially extends the range of marketing and energy services offered by a utility. The implementation process requires taking a program from its inception through its operational stages, while concentrating on generating and maintaining consumer interest and response. For DSM programs, this process often affects most of the functional units of a utility, from accounting to transmission and distribution. As a result, each utility function must be considered during DSM project planning. Four attributes – communication, commitment, flexibility, and simplicity – are considered as critical factors in successful DSM program implementation.

There are three basic requirements for a successful DSM program:

1. There must be a consumer with an end-use or application that can be made more efficient.
2. The necessary efficiency products must be available.
3. The consumer must be aware of the potential benefits of DSM and have a motivation (usually financial) to make the changes.

Although the potential for energy efficiency improvements is great in India, the two other conditions are not present.

DSM program implementation is the most important aspect of a DSM plan. It is at this stage that a utility can make a difference in its load and the way its customers use electricity. One key element in the success of DSM program selection and implementation is the identification and evaluation of consumer characteristics that influence acceptance and responses to DSM programs. Among consumer characteristics that influence the success of a program are demographics, income, knowledge, awareness, attitude, and motivation. External influences such as economic conditions, energy prices, technologies, regulation, and tax credits also influence consumers' decisions regarding fuel, appliance choices, and equipment efficiency.

DSM implementation strategies include:

1. ***Information programs,*** such as printed materials to educate consumers and raise their level of awareness of energy efficiency opportunities; seminars, workshops and conferences; energy audit programs; and labeling programs sponsored by the government.

2. ***Direct installation programs***, such as equipment installation, financing assistance, and operation and maintenance.

3. ***Load management programs*** to shift electric loads from one period to another, such as peak clipping and load shifting. Implementation of this program requires an appropriate tariff structure. Load management programs include interruptible rates, time-of-use rates, and real-time pricing.

4. ***Performance contracting,*** which generally relies on energy service companies (ESCOs) and financial institutions to provide services to consumers, particularly commercial and industrial

sectors. The ESCOs identify the measures to be installed, finance and install the measures, and sometimes assist in measure maintenance. Typically, the ESCOs receive payments from the utility for each kWh or kW saved and/or they receive payments from the customer, based on a share of the values of the savings achieved.

5. ***Financial incentives***, which includes rebate programs, low-interest/no-interest loan programs, and lease programs.

6. ***Market transformation strategies,*** which would result in changing the entire market for particular products. Besides the utilities, market transformation would also require the involvement of governmental agencies and manufacturers.

4. Benefit/Cost Analysis of DSM Programs

To compare DSM programs with other demand- and supply-side resources, four primary tests are widely used in the United States to identify cost-effective DSM programs: (1) the utility cost test, (2) the participant cost test, (3) the total resource cost test, and (4) the rate impact measure test.

1. The Utility Cost Test measures the net change in a utility's revenue requirement resulting from a DSM program. The test compares the reduction in marginal energy and demand costs with utility program costs, incentive payments, and increased supply costs for a period in which load is increased.

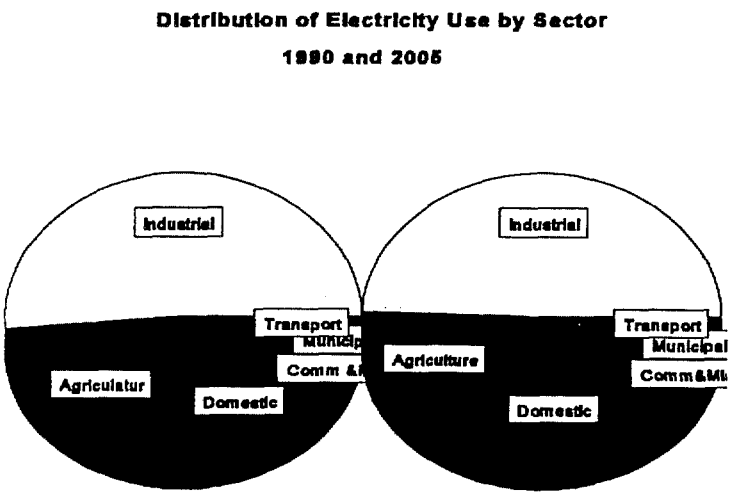
2. The Participant Cost Test measures the costs and benefits of a DSM program to a customer by comparing the reduction in the customer's utility bill, plus any incentive paid by the utility or governmental agencies, with the customer's out of pocket expenses. The test is often used as a **"first-cut"** in ranking program desirability and gauging potential program participation rates.

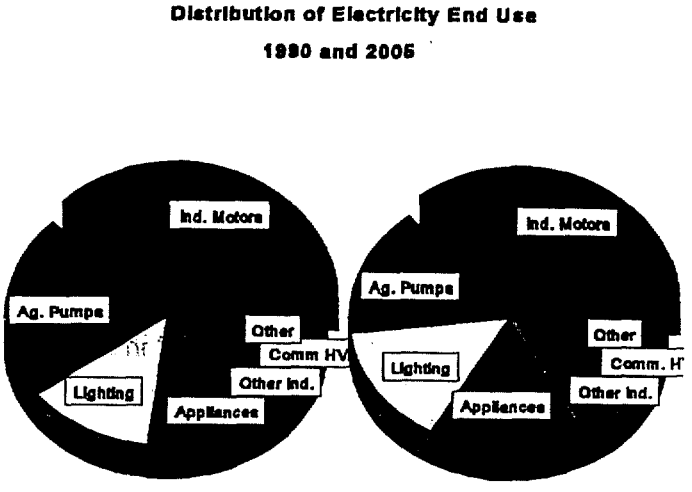
3. The Total Resource Cost Test measures the net cost of a DSM program as a resource option, based on the total costs of the program, including both participant and utility costs. Like the utility cost test, it measures benefits as reductions to energy and demand costs, but it also includes a review of all program costs, including installation, operation, maintenance, and administration, no matter who pays for them.

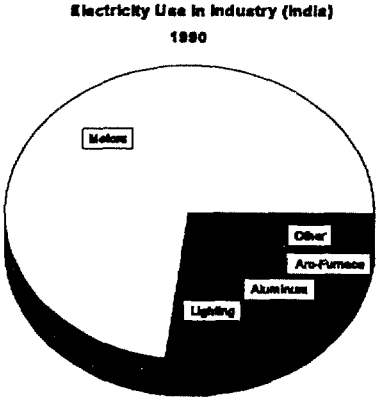
4. The Rate Impact Measure Test measures the direction and magnitude of the expected changes in rates for all customers when a utility implements a DSM program. The equation functions initially in the same manner as the utility cost test, comparing avoided supply cost savings with cost to the utility. It also measures the revenue-shifting effect unique to DSM when costs must be spread over a smaller sales volume. The shift reduces revenue requirements but not to the same extent as sales are reduced by DSM programs. The difference causes an increase in rates. If the utility has excess capacity and its average costs exceed its marginal costs, a DSM program will likely increase rates. The converse is true when marginal costs are forecast to exceed average costs.

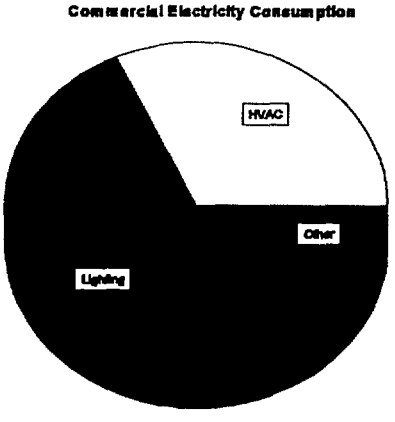
5. Demand-Side Management Targets in India

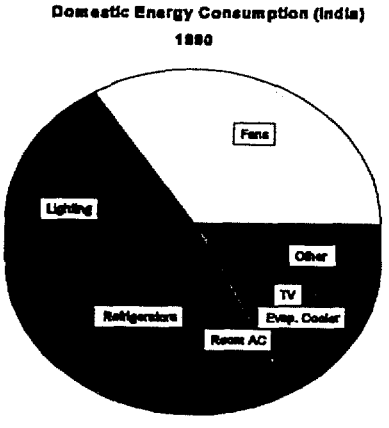
As the following figures show, industrial motors, agricultural pumps, lighting systems, fans, and appliances should be the main targets for Demand-Side Management in India.











Source: The World Bank

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6. DSM Implementation in India Through Energy Service Companies (ESCOs)

Energy Service Companies (ESCOs) have played a major role in DSM implementation in the United States and other Western countries through what is called "performance contracting." In a performance contract, the ESCO identifies energy saving opportunities in the consumer's facilities and implements those measures at no initial cost to the owner, maintains the measures for the life of the contract, and guarantees the energy savings. The services provided by an ESCO include the following:

- An investment-grade energy audit to identify energy and operational cost-effective savings opportunities and assess the associated risks
- Financing arrangements
- The purchase, installation, and maintenance of energy-efficient equipment; possibly maintenance on all energy-consuming equipment
- Training of operations and maintenance (O&M) personnel on new equipment
- Training of O&M personnel in energy-efficient practices on existing equipment
- Monitoring of the operations and energy savings, so reduced energy consumption and operating costs will persist
- Measurement and verification of savings
- A guarantee on the energy savings to be achieved.

Although technical functions of an ESCO may be similar in any country, social, political, and economic differences make it essential that its operation be designed to meet the local conditions. In India, the important element is the identification of key players in an ESCO operation. To market ESCO operation, creative financing options such as performance contracting, low-interest loans, and other financing mechanisms should be investigated and offered to potential customers.

Strategies to create a favorable atmosphere for development of an ESCO industry in India include:

1. Creating an awareness among consumers about the financial benefits of energy efficiency improvements and load management.

2. Informing commercial banks, leasing agencies, and other financing institutions about the benefits and procedures for effectively financing energy efficiency, especially regarding ESCO programs which offer guaranteed savings.

3. Conducting research to determine institutional barriers, such as tariff structures which keep energy prices artificially low; building codes, standards, and licenses which work against, or fail to encourage, energy efficiency; high import duties on energy-efficient equipment not manufactured in India; and procedures which discourage creation of ESCOs or joint ventures with foreign ESCOs.

4. The development of model contracts, which accommodate local laws and establish clear procedures for enforcing such contracts.

5. Analysis of "Business Laws" and recommendations to facilitate the creation of ESCOs.

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7. Barriers to DSM Implementation in India

DSM barriers would normally fall into the following three categories:

1. Those that are under the control of the electric utilities
2. Those that result from cultural or awareness problems
3. Those related to the institutions and infrastructure necessary for successful implementation of DSM programs.

I. Utility-induced Barriers

One of the necessary prerequisites of efficient electricity use is tariffs that reflect appropriate price signals. The present tariff structure reflects neither marginal costs nor embedded costs for each sector. Agricultural rates and some residential rates cover less than 50% of the costs, while HT industrial rates recover well over 100% of the costs. Tariffs must reflect the true cost of providing electricity. Power quality problems, including voltage and frequency fluctuations, will also prevent the use of some cost-effective technologies, such as fluorescent or CFL lights with mechanical ballasts and variable-speed drives. Voltage stabilizers can be used to compensate for voltage problems, but this reduces cost-effectiveness.

Suggested Solutions

1. Develop cost-based tariffs while, at the same time, developing better mechanisms for subsidizing poor households and farmers.

2. Install Time-Of-Use (TOU) meters and develop effective TOU tariffs for large commercial and industrial consumers. TOU tariffs must be based on an extensive load research, including price elasticity studies.

3. Develop interruptible tariffs to encourage customers to install back-up generators for peak periods.

4. Replace old, defective meters with new ones.

5. Develop the research capabilities of utilities, including load research and power quality improvements.

6. Conduct a cost/benefit analysis for direct control of agricultural pumps, and encourage use of solar, wind, and other renewable technologies for agricultural pumps.

7. Privatize distribution system. Profit motivation and cost minimization would help reduce losses, particularly commercial losses, and improve billing and collection practices.

8. Collect end-use appliance and equipment data to develop detailed conservation potential estimates and help target conservation programs.

9. Consider power quality problems in the design of DSM programs.

2. Cultural Barriers

If energy-efficient technologies are to achieve a significant level of market penetration, it is necessary to stimulate customer demand for efficient technologies. While the market for efficient technologies may originate through the efforts of equipment manufacturers to ***"push"*** their technologies through the marketing infrastructure, it is ultimately a market ***"pull"*** that will sustain a robust market for efficient technologies. Increasing customer demand for efficient technologies is essential to stimulate the expansion of the market infrastructure, and this expansion will, in turn, prepare the marketing infrastructure for further expansion. Without significant market pull, the marketing infrastructure for efficient technologies will stagnate, and market expansion will cease.

Limited customer awareness of efficient technologies is the primary marketing infrastructure barrier in all sectors. This problem is particularly acute in the residential sector.

High initial costs of energy-efficient equipment is another obstacle that keeps energy-efficient technologies from penetrating the marketplace in all customer sectors. In India, as in many other countries, consumers focus on first cost rather than life-cycle cost when making equipment purchasing decisions. Since energy-efficient equipment normally costs more than standard equipment, it is less likely to be preferred. In many industries, equipment purchase decisions are normally made by those who are not responsible for paying the electricity bills. Thus, speed of product delivery and lower initial costs are the most important criteria in their purchasing decisions.

Suggested Solutions

1. Increase public awareness, using the news media and by establishing energy conservation centers. These centers could provide easy access to energy-efficient products and services information for consumers to make informed choices on energy-consuming equipment.

2. Increase consumer awareness, using case studies and demonstration projects in similar industries.

3. Provide free energy audit services to residential and small commercial and industrial consumers.

4. Make annual energy audits mandatory for large commercial and industrial consumers.

5. Require implementation of all energy audit recommendations with paybacks of less than one year.

6. Follow up on DSM implementation by consumers.

7. Require industries to report energy intensities of their operation in their annual reports.

8. Require assignment of energy managers for large industrial and commercial facilities.

9. Facilitate DSM implementation through ease of financing, direct installations of energy-efficient equipment, and financial incentives.

3. Institutional Barriers

Another element that is necessary for the successful operation of DSM programs is an infrastructure in the economy that can deliver, sell, install, and maintain energy-efficient technologies. This includes availability of domestically produced energy-efficient equipment, availability of reasonable financing, and existence of effective governmental institutions. Current institutional barriers include:

- Lack of a regulatory mechanism for the utilities to recover DSM costs.
- Lack of reliable consumer data.
- Lack of sufficient numbers of qualified energy auditors and energy audit equipment.
- Lack of sufficient numbers of Energy Service Companies to deliver, sell, install, finance, and guarantee performance of energy-efficient products.
- Lack of appropriate financial mechanisms for energy-efficiency projects.
- Lack of an effective national institution to create awareness and to facilitate DSM implementation.
- Long delivery time requirement for energy-efficient equipment.
- Lack of appropriate energy efficiency codes and standards.

Suggested Solutions

1. Accelerate privatization of electric utilities.

2. Speed up creation of Regulatory Commissions, which would hopefully lead to a cost-based tariff for different sectors and create a more predictable environment for the utilities.

3. Accelerate market transformation of energy-efficient products through mandatory codes and standards.

4. Set deadlines for mandatory standards on end-use products.

5. Develop appliance rating schemes. Provide information on energy efficiency at the point of sale for consumers to make informed decisions on product purchases.

6. Establish credible, independent testing centers for energy efficient products. Facilitate consumer testing of products at these testing centers.

7. Develop the skills and expertise to market energy efficiency projects. This requires two elements. First, there must be sufficient business available to encourage existing firms to expand or to attract new entrants. Then it is necessary to provide both training and experience to allow these firms to become successful.

8. Once enough data has been collected to determine which technologies are required to support DSM programs, it may be necessary to work with manufacturers and distributors to make these products available. It may be necessary to work with the distribution organizations to jointly develop plans to promote these products.

9. Develop energy conservation programs in State-owned facilities using ESCOs. Make public facilities more efficient, incurring little or no capital costs, by getting the State Energy Minister to mandate energy efficiency improvements over time. Use Energy Service Companies to implement these measures.

10. Make Integrated Resource Planning (IRP) mandatory, and require utilities to report their DSM activities annually.

11. Provide tax benefits and lower custom duties for manufacturers and importers of energy-efficient products.

12. Promote greater involvements of NGOs such as CERC, PUBLIC, and FOSET.

13. Develop certification programs for motor rewinding firms and energy auditors.

14. Develop better financing mechanisms for energy efficiency measures.

15. Develop training programs for energy auditors, ESCOs, and energy managers.

16. Investigate costs and benefits of daylight saving time changes.

17. Build the necessary end-use market databases.

18. Create a National Forum for the development, implementation, and monitoring of energy efficiency activities in India.

Based on RMA experience in India, cultural barriers and institutional constraints are the most significant deterrents to DSM implementation in India. This is the main reason for placing high priority on institutional reforms and developing energy education and awareness programs. Through the National Energy Efficiency Program, India has earmarked US$ 3.2 billion to save 5,000 MW of electricity. Developing effective and sustainable DSM programs, along with new power generation to meet India's electric power needs, could not be achieved without appropriate policy intervention to facilitate institutional reforms and to increase awareness.

8. Key Players in DSM implementation in India

The following is a list of players (other than utilities) who would play a key role in the implementation of DSM programs.

1. State and Central Governments

The government, as the major producer and consumer of power, will benefit from DSM more than any other actor. The role of government would be:

- Initiating energy conservation activities in all government facilities.
- Creating awareness on energy efficiency among consumers.

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- Expediting privatization of utilities.
- Creating a Regulatory Commissions, which would lead to a cost-based tariff for different sectors and create a more predictable environment for the utilities.
- Setting deadlines for mandatory energy efficiency standards on end-use products.
- Making annual energy audits a requirement for large commercial and industrial users.
- Requiring large industrial users to assign energy managers.
- Following up on the implementation of energy efficiency measures by consumers.
- Making Integrated Resource Planning (IRP) mandatory for the utilities.
- Requiring utilities to report their DSM activities annually.
- Requiring industries to report their energy intensities in their annual reports.
- Encouraging creation of energy parks or energy conservation centers in large urban areas.
- Providing tax benefits and lower custom duties for manufacturers and importers of energy-efficient products.

2. Non-Governmental Organizations (NGOs)

NGOs, such as CERC, PUBLIC (People United for Better Living in Calcutta), and FOSET (Forum of Scientists, Engineers & Technologists), and environmental groups could play an effective role in information dissemination and energy awareness among consumers.

3. Manufacturers

To increase market penetration of energy-efficient products, there is a need for both "market push" by the government (through regulation), manufacturers, and trade associations as well as "market pull" by consumers. However, it is the market pull which will create a sustainable demand for these products, and this could be achieved through awareness as well as ease of access and reasonable prices for those products. Major manufacturers in India should take the lead in producing energy-efficient products voluntarily.

4. Energy Service Companies (ESCOs)/Facilitators

Without the creation of these "facilitators," consumers' response to market forces will be very slow. These facilitators could remove most of the barriers which impede speedy implementation of DSM programs, such as financing, installation, and maintenance of energy-efficient products.

5. Financial institutions

Financial institutions, either directly or indirectly (through ESCOs), could play an important role by easing financing and providing loans at reasonable rates.

6. Municipalities

As a large energy users with limited funds, municipalities have great incentives to improve energy efficiency at their facilities, particularly in water supply and discharge pumping systems as well as street lighting. They could also play an important role in enhancing consumers' awareness of energy and environmental issues.

9. Concluding Remarks

In the United States and other Western countries, DSM programs were designed to improve load factors and energy efficiency beyond the meter on the consumer side. However, in India the problems are on both sides of the meter as well as the meter itself. It may be appropriate to rename DSM in India to BGM (Beyond Generation Management). At every meeting with Indian utilities, their main concerns in "DSM" were T&D loss reduction and metering, which are interrelated. Knowledge of their customers on the part of the utilities is very limited or nonexistent. Indian utilities are willing to invest in metering as well as any reasonable investment in T&D loss reduction. However, because of uncertainty about the future, particularly for SEB's, Indian utilities are extremely cautious in taking any action in DSM on the consumer side. Even the TOU tariff, which was introduced by several utilities, has been ineffective. Impact of TOU tariffs on consumers and elasticity of demand must be studied scientifically before any tariff development. There must be substantial tariff differentials for peak and off-peak. This will encourage expansion of businesses and industries which could operate during off-peak hours. It will also encourage load shifting to large consumers, such as thermal storage. In conclusion, to make things happen on the other side of the meter, the focus should not be only on utilities. Other key players must also become actively involved.

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