PN-ACR-961

REPORT

ON

DESIGN AND IMPLEMENTATION OF LOAD RESEARCH PROGRAM

(MILESTONE 11C)

Part One

March, 2001

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Executive Summary

This report covers the trip made between March 1 through March 18, 2001, by Dr. Hameed Nezhad for Activity 11 C: "Design and Implementation of a Load Research Program" of the USAID Energy Conservation and Commercialization (ECO) project. Mr. V.M. Thakor, a senior consultant to ECO project and Mr. B. Dixit from Saha Sprague, an Indian subcontractor to the project, accompanied Dr. Nezhad.

The ECO project is being implemented by Bechtel National Inc (Nexant Inc) under a USAID contract, LAG-I-00-98-0000. This contract has been issued by the USAID Mission in New Delhi as a part of the IQC (Indefinite Quantity Contract) currently in place through USAID's Global Bureau. The project contract was signed on February 29, 2000 and continues through December 2003.

This milestone is the third in Activity 11: "Electric Utility DSM/Energy Efficiency Capacity Building." The first milestone "Establishing Selection Criteria and Selection of the Focus State" has been completed. Rajasthan was selected as the focus state. The second activity "Establishing a DSM Cell in at least 1 DISCO of the focus state and assess their staff needs" has also been completed. A DSM Cell has been established at Jaipur DISCOM and they have been trained on DSM concepts.

During this trip Dr. Nezhad, Mr. Thakor and Mr. Dixit visited Jaipur and provided technical assistance to Jaipur DISCOM's DSM Cell in load research design and implementation. More specifically,

- The DSM Cell team was educated about the relevance of load research to overall objectives of Jaipur DISCOM. Using DECIDE2000®, a decision support software developed by Dr. Nezhad, Jaipur DISCOM's overall objectives and its future load management strategies for different consumer groups were prioritized.
- A functionally-oriented organizational structure for the DSM Cell was proposed;
- Consumer survey questionnaires for agricultural, domestic, commercial, and industrial sectors were developed and tested;
- A long-term load research plan was developed. The load research will be conducted in three phases: Phase 1: Load research at a selected substation; Phase 2: Load research at Jaipur City; and Phase 3: Load research at Jaipur DISCOM;
- An outline of load research workshop to be conducted in Jaipur and Bagalore was proposed.

In addition, the team of consultants visited Mr. Mr. Ashok Singhvi, IAS, Chairman and Managing Director of Jaipur DISCOM to gain his support of DSM activities at Jaipur DISCOM. A meeting was also held with Mr. S. Krishnaswamy from the Consumer Unity & Trust Society (CUTS) and discussed their possible role in consumer surveys and awareness campaign. At the end of this trip, Dr. Nezhad and Mr. Thakor accompanied

Mr. Charlie Fafard to USAID Delhi and presented a brief summary of their activities and their findings to Mr. Dick Edwards, Dr. Ashok Sarkar and Mr. Srinivasan Padmanabhan.

Background

The Government of India (GOI) and the US Agency for International Development (USAID), signed a joint project agreement on 28 January 2000 that calls for the implementation of the Energy Conservation and Commercialization Project (ECO). The ECO is a 4-year program that targets the reduction of greenhouse gas (GHG) emissions per unit of electricity generated and consumed in India.

ECO aims to promote widespread commercialization of energy efficiency technologies and services in India, thereby contributing to the reduction in growth of GHG emissions. Assistance will be provided for developing a market-oriented policy environment for commercialization of energy conservation, and enhancing the capabilities of the private and financial sectors for deploying market-based mechanisms for energy efficiency investments. The ECO project supports USAID's Climate Change Strategy and will contribute to USAID/India's Strategic Objective for increased environmental protection in energy, industries and cities.

ECO will facilitate the commercialization of energy services and technologies through a two-pronged strategy: (1) Energy Efficiency Market Development and Financing (Markets Component), and (2) Energy Efficiency Policy and Institutional Reforms (Policy Component).

The Markets Component will include the following major activities:

(1) Technical and project structuring services for sponsors;
(2) Development of financial incentives for credit enhancement / risk mitigation;
(3) Support to energy efficiency services industry;
(4) Efficient technology promotion;
(5) Market conditioning and promotion; and
(6) Non-sugar co-generation market development.

The Policy Component will cover policy, regulatory and institutional reform issues at the central and state levels, and will include the following major activities:

(7) Energy efficiency policy and institutional support;
(8) Energy efficiency standards for labeling for consumer appliances;
(9) Energy efficiency improvement in Government facilities and private buildings;
(10)Electric Utility DSM / energy efficiency capacity building;
(11)Development of State energy efficiency financing schemes; and
(12)DSM / energy efficiency within privatized distribution utilities.

Technical assistance (TA) and training will be provided to various government agencies to help them create a market-oriented policy environment conducive to investment in efficiency. TA and training will be provided to the private and financial sector to design and implement energy conservation projects. The Ministry of Power (and the subsequent Bureau of Energy Efficiency) will be the partner agency for the ECO project. State-level activities under the Policy Component will be coordinated with the State Regulatory Commission and State Electricity Boards (including its functionally unbundled entities) of the focus-state.

This report includes work done under one portion of Activity 11 in the Policy Component: "Electric Utility DSM/Energy Efficiency capacity building."

1. Electricity Supply and Demand Scenarios for Rajasthan

Rajasthan state grid has access to 4,056 MW of generating capacity of which 1,302 MW was fully owned and operated by RSEB. Since July 2000, RSEB's successor entity for generation, the Rajasthan Rajya Vidyut Utpadan Nigam Limited (RVUN), now owns and operates the fully-state-owned generation facilities, while the successor transmission company, Rajasthan Rajya Vidyut Prasaran Nigam Limited (RVPN) operates those stations which are jointly-owned with other states. The system covers a large geographic area of 342,000 sq. km, two-thirds of which is desert with low population density. Annual per capita electricity consumption is 302 kWh, lower than the average in India.

The grid presently serves over 5 million customers of which domestic and agriculture customers, account for 4.3 million. Figure 1 shows electricity demand by sector as percent of sale. According to this figure, agriculture sector is the largest consuming sector in Rajasthan. However, as Figure 2 shows, more than half of the utility's income comes from the industrial sector, while agriculture sector accounts for only 7% of total revenues.

Figure 1
Rajasthan Electricity Demand by Sector (% of sale)

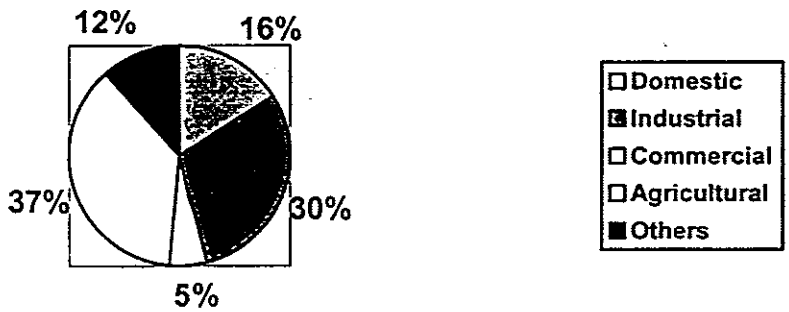
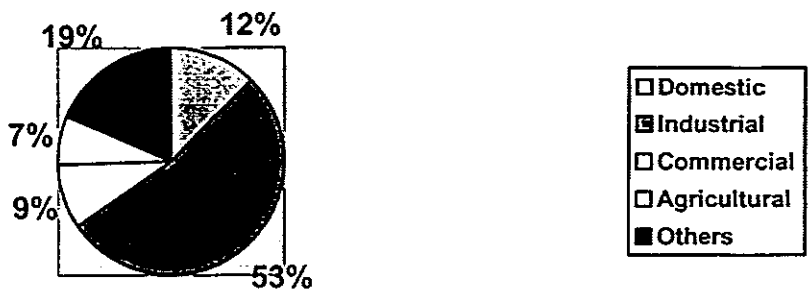


Figure 2
Rajasthan Electricity Revenue by Sector (% of sale)



Apart from RSEB's successor entities, two other state-owned institutions are involved in the development of power supply, namely, the Rajasthan Energy Development Authority (REDA) and the Rajasthan State Power Corporation Limited (RSPCL). REDA was established in 1985 with the objective of promoting and developing the use of non-conventional energy sources. RSPCL was established in 1995 with the objective of developing power generation capacity within the state from alternative sources of energy, including solar thermal, wind and hydro.

Rajasthan power sector suffers from a severe shortfall in power supply. Energy shortages have increased from about 7.8% in 1991 to about 15% in 1998, while the deficit in peaking capacity worsened from 14% to nearly 23% during the same period.

According to the "*Power Line Research-2000 SEB Report-State of SEBs,*" Rajasthan peak demand in 98-99 was 3,651 MW and peak demand met was 3,498 MW and projected peak demand in 2001-2002 is 5,606 MW. Thus, a shortage of 2,108 MW.

Electricity sales grew at an annual rate of 9% over the last decade with most of the growth accounted for by consumer categories availing of subsidized tariff, i.e., domestic and agricultural users. Unserved demand is significant as evidenced by a huge backlog in service connections to about 380,000 customers. Due to funding constraints, RSEB's generating capacity had not kept pace with the increase in electricity demand, such that by mid-90s the share of power purchases from outside the State exceeded 50% of total grid availability.

RSEB's operations were marked by frequent service interruptions, unacceptable voltage and frequency swings, high system losses and poor cost recovery. System losses are estimated at 42%. Over the past decade, cost coverage from revenue has been on a decline from 91% to 76%, resulting in a revenue deficit of 24% in FY1999.

While the grid has reached 90% of the villages, less than 40% of the population has access to electricity since the level of house connections is comparatively low. Power shortages in rural areas not only affect agricultural production but also constrain avenues for non-farm income-generating activities, aggravating poverty in the rural areas.

The unconstrained demand for electricity services in the state in the next ten years is projected to grow at about 7% per year. According to a World Bank document, eliminating the power deficit, through supply and end-use efficiency improvements, requires an additional capacity of roughly about 1000 MW over the next seven years. The associated investments are estimated to cost Rs. 30.6 billion for generation and a minimum of Rs. 85.4 billion for rehabilitation and expansion of transmission and distribution system. This amounts to Rs. 116 billion for this additional 1000 MW or about Rs. 116,000 per kW (or $2,760 per kW). This figure clearly demonstrates cost effectiveness of ***demand-side management and energy efficiency*** improvements.

On July 19, 2000, the entire business of RSEB was transferred into five companies through statutory transfer scheme under the Rajasthan Power Sector Reform Act. The resulting new entities are:

- RVUN, which owns and operates RSEB's existing power stations, and will take up on-going and new generation projects;
- RVPN, responsible for transmission and bulk supply of electricity;
- Ajmer Vidyut Vitran Nigam Limited (Ajmer DISCOM), Jaipur Vidyut Vitran Nigam Limited (Jaipur DISCOM), and Jodhpur Vidyut Vitran Nigam Limited (Jodhpur DISCOM), as distribution companies.

The operating relationships among these companies are as follows: RVPN would enter into Power Purchase Agreements (PPAs) with RVUN. Additional generation will be procured through Central Government owned generating companies and IPPs. Distribution companies may also enter into direct PPAs with generators and other bulk suppliers, ad over time, RVPN will increasingly focus on transmission and system operations.

During the four-year reform transition period, FY2001-05, Rajasthan plans to expand its transmission and distribution network in order to extend electricity service to an additional 750,000 customers.

A main thrust of the loan provided by the World Bank is to help distribution system particularly in the rural areas, improving system voltages and supply reliability, and in investing in the metering required to facilitate the privatization exercise.

Rajasthan's load curve describing the State's demand for electricity is almost flat resulting from ***load restrictions*** and consumer ***supply rationing*** by rotation, due to inadequate grid supplies. In 1998, the system peak varied from a high of about 3,169 MW in February 1998 to a low of about 1,868 MW in August 1998. This wide seasonal variation is due to the change in irrigation requirements between the food-grain planting seasons in the first quarter and in the monsoon months.

Rajasthan operates about 17,000 km of transmission, 25,000 km of 33kv sub-transmission, and 344,000 km of distribution lines. Its transmission and distribution substations have an installed capacity of about 16,000 MVA.

About a third of RSEB's load was supplied to industry at high voltage, where losses are minimal, thus the other two-thirds of the system incur technical and non-technical losses well in excess of 50%.

The failure rate of distribution transformers in recent years has been around 15%. In FY 2000, of the 178,586 transformers installed, 20,663 failed. Overloading was the main cause of these failures.

2. DSM Cell Organizational Structure

After a careful review of the functional requirements of DSM Cell, the following organizational structure was proposed to Jaipur DISCOM.

Description of DSM Staff Positions

DSM Cell Team Leader:

Manages DSM area overall, including budgets, staffing, interactions with upper management, consultants, etc. Must have direct access to upper management of the utility. Must have extensive contacts throughout the company. Must be someone with a vision of the future of the utility and the role DSM could play in that future.

Engineers:

Perform a variety of engineering tasks related to researching customers' current energy use and identifying energy efficiency opportunities within customer facilities. Also, they must understand the distribution system. Need a minimum of two engineers, specializing in electrical/power engineering and mechanical engineering.

Marketing Specialist / Customer Relations:

Responsible for developing marketing materials and strategies, and interacting extensively with customers and key customer groups, in order to educate customers and publicize utility's DSM programs. An ideal candidate would be someone with an engineering undergraduate degree and an MBA degree.

Financial/Economic Analyst:

Performs several key tasks related to designing and evaluating DSM programs. This position is chiefly responsible for developing all DSM programs and assessing their cost effectiveness to the utility and its customers. A deep understanding of utility's financial issues is required for this position.

Information Analyst:

Develops and operates computer software and databases for the purpose of storing and analyzing data related to the following areas: market research, end-use research, DSM program tracking data, and DSM monitoring and evaluation data as well as generating effective reports. Supports other functions as needed. Should have a good knowledge of computers, information systems, and principles of statistics.

DSM Cell Members' Tasks

DSM Team Leader

- Managing DSM Cell
- Interacting with other departments within the utility
- Interacting with outside firms

Engineering

- Energy audits
- End-use research
- System research
- DSM implementation
- DSM monitoring and evaluation

Marketing/Awareness

- Developing marketing information
- Market research
- Seminars and meetings with consumers

Finance/Economics

- Tariff design support
- Budgeting
- Benefit/cost analysis
- DSM impact & process evaluations
- Cost-of-service analysis

Database & Information Systems Development

- Database management
- Report generation
- Statistical analysis
- Support other functions

DSM Cell Responsibility Matrix

Job Functions	DSM Cell Leader	Engineers	Marketing Specialist	Financial/ Economic Analyst	Information Analyst
Energy Audits	SU	P	S	S	S
End-Use Research	SU	P	S	S	S
System Research	SU	P	S	S	S
DSM Implementation	SU	P	S	S	S
DSM Monitoring & Evaluations	SU	P	S	S	S
Developing Marketing Information	SU	S	P	S	S
Market Research	SU	S	P	S	S
Seminars & Meetings	SU	S	P	S	S
Budgeting	SU	S	S	P	S
Tariff Design Support	SU	S	S	P	S
Benefit/Cost Analysis	SU	S	S	P	S
DSM Impact and Process Evaluations	SU	S	S	P	S
Database Management	SU	S	S	S	P
Report Generation	SU	S	S	S	P
Statistical Analysis	SU	S	S	S	P

Legend: SU = Supervisory; P = Primary Responsibility; S = Secondary Responsibility

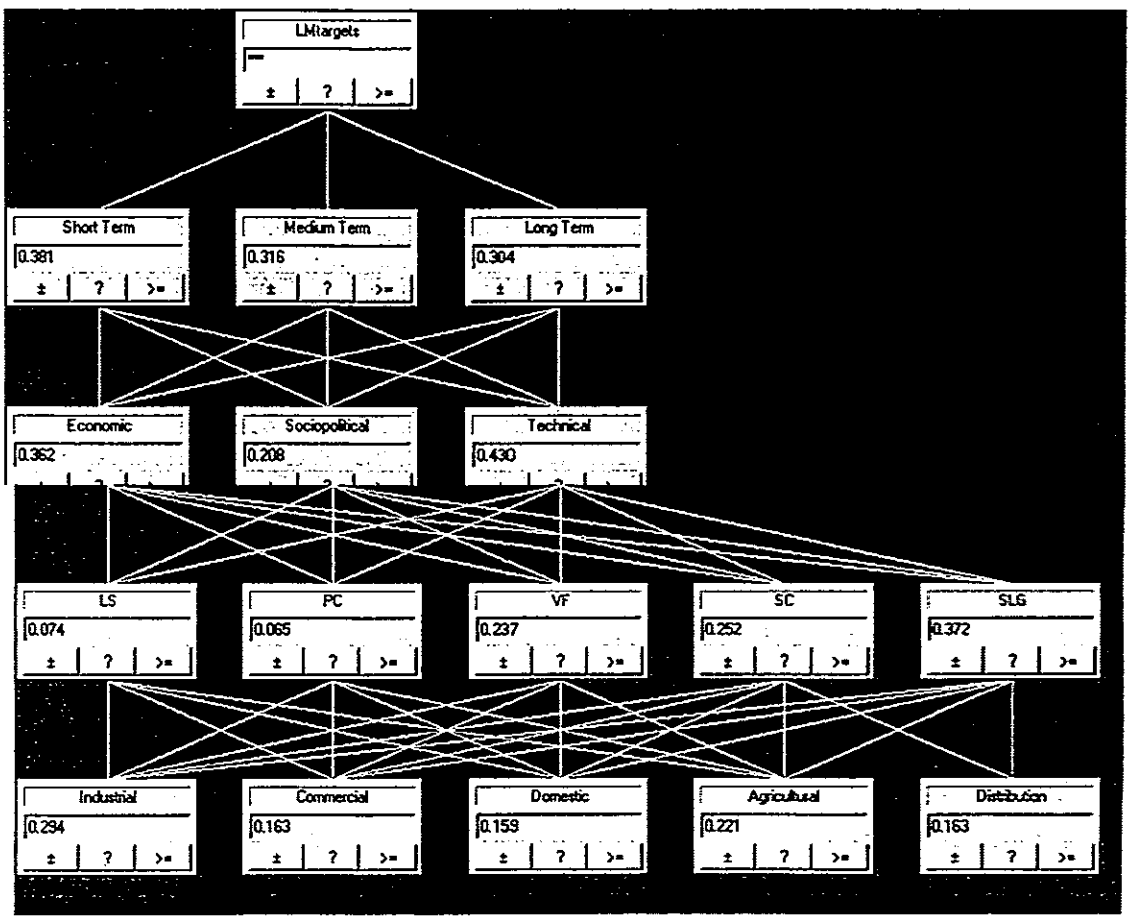
3. Load Research Design at Jaipur DISCOM

A DSM cell consisting of three executive engineers, two assistant engineers and one junior engineer was formed at Jaipur DISCOM, a newly formed distribution company covering Jaipur City and its surrounding area.

To demonstrate the significance of load research for Jaipur DISCOM the following hierarchical model was developed by the team and the elements in the model were prioritized using DECIDE 2000®, a software program developed by Dr. Nezhad.

Figure 3

Load Management Model using DECIDE2000®



Descriptions of the Elements in the Model

1. Time Periods

Three time periods were selected:

- Short term being up to three years;
- Medium term being between three to seven years; and
- Long term being more than seven years

2. Jaipur DISCOM Objectives

Three broad objectives were set for the utility:

- Economic objectives which include costs and benefits of variety of load management programs and return on investments;
- Sociopolitical objectives which include meeting regulatory requirements and meeting public demand for access to power, power quality, power reliability, tariff-level expectations;
- Technical objectives, which include adequate power supply, transmission, distribution and metering requirements.

3. Load-Shape Objectives

Five load shapes objectives were selected and prioritized:

- Load Shifting (LS) from peak to off peak;
- Peak Clipping (PC);
- Valley Filling (VF);
- Strategic Conservation (SC) meaning increasing energy efficiency for both the supply system and consumers' energy use;
- Strategic Load Growth (SLG) meaning growing the load with a desirable load factor.

4. Sectors

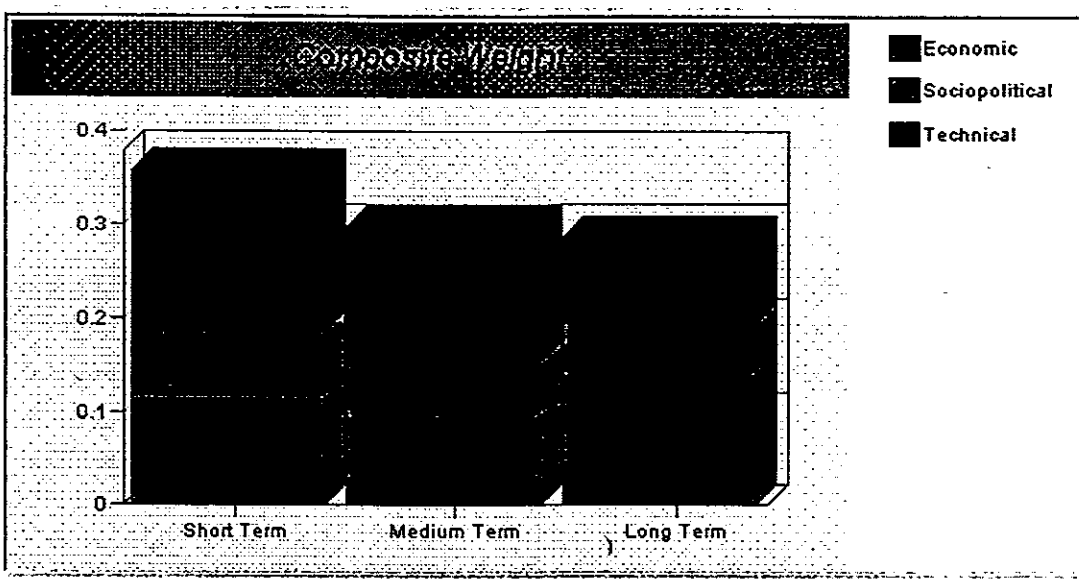
Targeted sectors include both consumer sectors and the utility's own supply system as shown below:

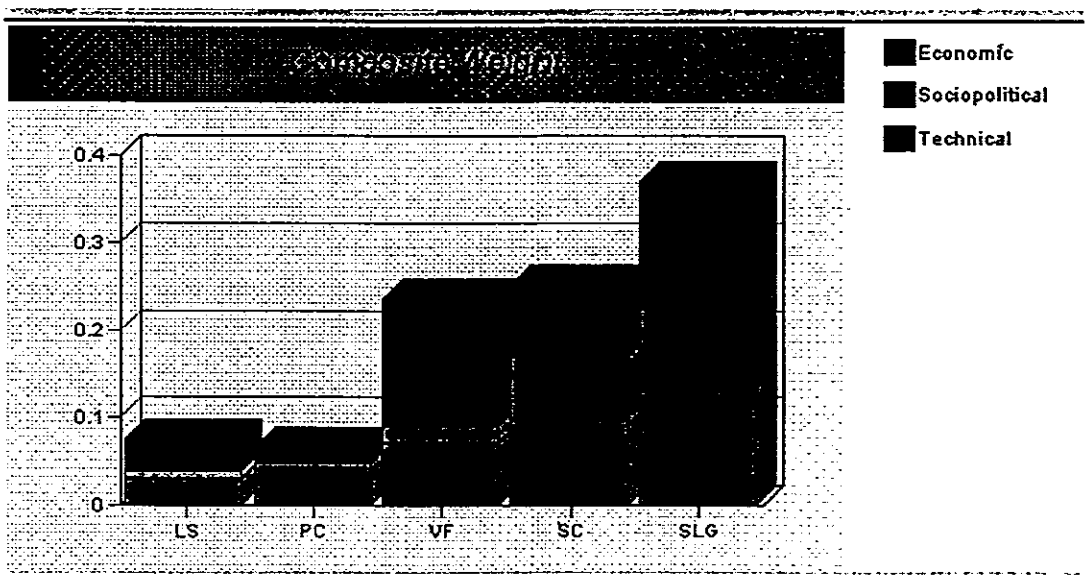
- Industrial sector;
- Commercial sector;
- Domestic sector;
- Agricultural sector; and
- Transmission and distribution system

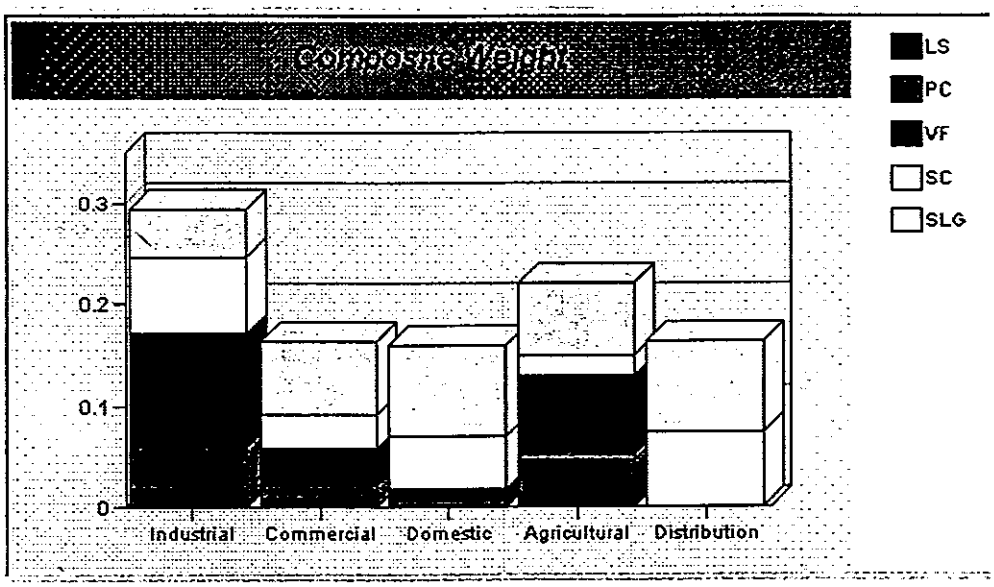
After a lengthy discussions, the following priorities were assigned to the above elements:

Figure 4

Load Management Priorities at Jaipur DISCOM Using DECIDE 2000®







This exercise clearly demonstrated the significance of load research to the well being of a utility and usefulness of load research data for top-level decisions on tariffs, new investments in generation, transmission, and distribution, as well as reporting cost-of-service to each customer category to regulatory authorities. Also, the DSM team realized that in order to quantify the above elements, actual data is needed that is currently either not available or not well documented. Thus, a comprehensive load research program is necessary to fill the gaps in the above model and replace subjective judgments and wild guesses with actual, reliable data.

4. Load research process at Jaipur DISCOM

Load research process at Jaipur DISCOM was divided into three distinct phases:

Phase 1: Load research at a suitable substation;
Phase 2: Load research at Jaipur City; and
Phase 3: Load research at Jaipur DISCOM

To select a suitable substation to start the load research process, the team of consultants and DSM Cell team visited several substations; A 33 KV substation with six distinct feeders was selected because of its customer characteristics and data availability at the substation. Table 1 shows customer characteristic of this substation. The numbers in the parentheses indicate the number of surveys that must be conducted for each customer group.

After a thorough load research at this substation, both on the system side and on the customer side, we will be in a better position to decide how extensive the other two phases should be. Then, a more detailed plan must be developed.

Table 1
Customer Characteristics at 33 KV substation

Sectors	Shipra Path Feeder (235092) [L. 1.039km]			SFS Feeder (91) [L. 1.370km]		
	No. of consumers	kW	kWh/month	No. of consumers	kW	kWh/month
Domestic	1623 (50)			1,482 (20)		
Commercial	118 (10)			92 (5)		
Small Ind.	5 (5)			14 (5)		
Medium Ind	1 (1)			0		
Street Light	5 (1)			6 (0)		
Agriculture	0			0		
Mixed load	0			0		
Large Ind (H	0			0		
Total	1,752			1,594		

Sectors	Thari Market Feeder (96) [L. 1.309km]			Goliawas Feeder [L. 6.6km]		
	No. of consumers	kW	kWh/month	No. of consume	kW	kWh/month
Domestic	1,693 (2)			292 (5)		
Commercial	149 (2)			64 (5)		
Small Ind.	9 (2)			6 (6)		
Medium Ind	0			0		
Street Light	9			0		
Agriculture	0			136 (10)		
Mixed load	1 (1)			0		
Large Ind (H	0			0		
Total	1,861			498		

Sectors	Rico Feeder (93) [2.612km]				Fun Kingdom (97) [L.0.5km]		Total No. Of Consumers	Total kW	Total kWh/month
	No. of consumers	kW	kWh/month	No. of consu	kW	kWh/month			
Domestic	23(5)						5,113		
Commercial	74(5)						497		
Small Ind.	85(5)						119		
Medium Ind	53(10)						54		
Street Light	2						22		
Agriculture	0						136		
Mixed load	1(1)						2		
Large Ind (H	1(1)			1(1)			2		
Total	239						5945		

Note: The numbers in parentheses represent the number of surveys to be done. Columns with kW and kWh/month will be completed by Jaipur DISCOM's DSM Cell.

5. Consumer Survey

One survey questionnaire for each sector--industrial, commercial, domestic, and agricultural-- was designed by the team. Appendix A includes these questionnaires. The objectives of these surveys are:

- To explore consumer attitudes towards energy efficiency;
- To use these surveys as a means of making consumers aware of energy efficiency opportunities;
- To collect information on how consumers use energy; and
- To develop load profiles for each customer group.

A total of 158 surveys are planned for the period beginning March 20 and ending May 18. Table 2 shows the number of customers to be surveyed under each customer category. It was recommended that after several sample surveys, DSM team should revise the surveys, if necessary, in order to get a better picture of how Jaipur DISCOM customers use energy.

Table 2

Number of Consumers to be Surveyed under the 33 KV Substation

Sector	Total No. of Consumers	Number of surveys	Surveyor
Domestic	5,113	82	A Subcontractor
Commercial	497	27	A Subcontractor
Small Industries	119	23	DSM Cell
Medium Industries	54	11	DSM Cell
Large Industries	2	2	DSM Cell
Agricultural	136	10	A Subcontractor
Street Lighting	22	1	DSM Cell
Mixed Load	2	2	DSM cell

6. Load Research Plan for Jaipur DISCOM

As it was mentioned earlier in this report, load research will be conducted in three phases at Jaipur DISCOM. The first Phase which covers only one substation should be completed within three month and should provide valuable information to DSM Cell team and the team of consultants to plan the next two phases of research. Using Microsoft Project software and a multimedia projector all the members of DSM Cell and the consultants participated in developing load research plan for Jaipur DISCOM. Figure 5 shows the results.

Each Phase of load research is also divided into five set of activities:

1. System load research;
2. Consumer surveys;
3. Detailed audits of selected consumers;
4. Database development;
5. Analysis of data and development of load profiles for the system and each consumer group.

Jaipur DISCOM's DSM Cell will be responsible for the following activities for each phase of load research:

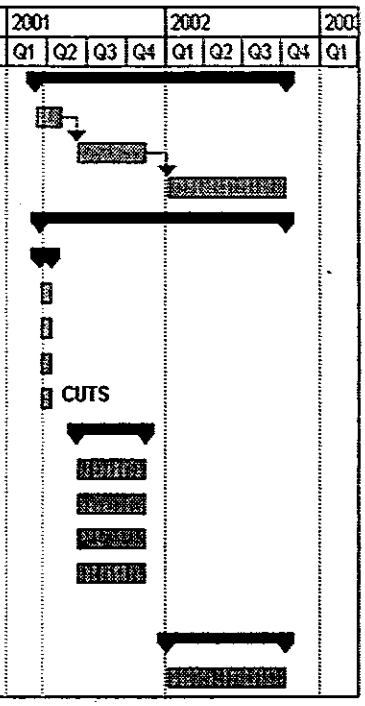
1. System load research;
2. Industrial consumer surveys;
3. Development of database for the system;
4. Development of database for industrial sector;
5. System load profiles;
6. Load profile for industrial consumers;
7. Street lighting load profiles.

The rest of the activities for each phase of the load research should be implemented by Nexant and its subcontractors:

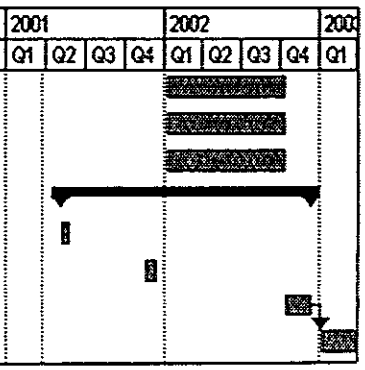
1. Consumer surveys of domestic, commercial, and agricultural sectors;
2. Detailed audits of selected consumers;
3. Analysis of surveys;
4. Development of databases for domestic, commercial, and agricultural sectors;
5. Load profiles for domestic, commercial, and agricultural sectors;

Figure 5
An Overview of Load Research Plan for Jaipur DISCOM

ID	Task Name	Start	Finish
1	**1. Database Development-System**	**Wed 3/7/01**	**Fri 10/11/02**
2	Phase 1: SFS Substation database	Wed 3/7/01	Fri 5/4/01
3	Phase 2: JaipurCity	Mon 6/11/01	Fri 11/16/01
4	Phase 3: Jdiscom	Mon 1/7/02	Fri 10/11/02
5	**2. Database Development- End-Use**	**Thu 3/15/01**	**Fri 10/11/02**
6	**2.1. Phase 1: SFS Substation Customers**	**Thu 3/15/01**	**Fri 4/13/01**
7	Domestic	Thu 3/15/01	Fri 4/13/01
8	Commercial	Thu 3/15/01	Fri 4/13/01
9	Industrial	Thu 3/15/01	Fri 4/13/01
10	Agricultural	Fri 3/16/01	Fri 4/13/01
11	**2.2. Phase 2: Jaipur City Customers**	**Mon 6/11/01**	**Fri 11/16/01**
12	Domestic	Mon 6/11/01	Fri 11/16/01
13	Commercial	Mon 6/11/01	Fri 11/16/01
14	Industrial	Mon 6/11/01	Fri 11/16/01
15	Agricultural	Mon 6/11/01	Fri 11/16/01
16			
17	**2.3. Phase 3: J Discom Customers**	**Mon 1/7/02**	**Fri 10/11/02**
18	Domestic	Mon 1/7/02	Fri 10/11/02



ID	Task Name	Start	Finish
19	Commercial	Mon 1/7/02	Fri 10/11/02
20	Industrial	Mon 1/7/02	Fri 10/11/02
21	Agricultural	Mon 1/7/02	Fri 10/11/02
22	**3. Data Analysis and Data Presentation**	**Mon 5/7/01**	**Fri 12/13/02**
23	3.1. Phase 1: SFS Substation	Mon 5/7/01	Fri 5/25/01
24	3.2. Phase2. Jaipur City	Mon 11/19/01	Fri 12/14/01
25	3.3. Phase 3: J Discom	Mon 10/14/02	Fri 12/13/02
26	4. Develop annual profitability curve for JDoscom	Mon 1/6/03	Fri 3/28/03



Notes:

For Task 1

1. Develop system diagrams
2. Provide equipment details--transformers, switch gears, control panels, and instruments.
3. Recording available data

For Task 2

1. Develop database of customer numbers and characteristics for each subcategory (domestic consumers could be selected based on their energy consumption).
2. Select target consumers for surveys
2. Conduct surveys
3. Conduct detailed audits of selected customers
4. Develop the database

For Task 3

Develop Hourly Load Profiles for a typical working day, weekend, and holiday for each season:

1. System at selected EHV/HV substations.
2. System at 11 kV feeder
3. Distribution substation.
4. Customer profiles for each category under selected substations
5. Procure or develop LR software
6. Enter data and analyze data
7. Develop load profiles for system and for customer categories.

For Task 4

Develop a cost profiles for different customer categories showing cost of service and revenues for each customer category and the total system.

7. Load Research Software

The following load research software programs are popular in the United States. However, most of these software programs are designed to support TOU meters and are highly quantitative. It is recommended that Jaipur DISCOM DSM Cell should initially either use spreadsheets or a cheaper software such as Visualize-IT. After improvements in metering, the decision could be made about the type of software that would be compatible with the installed meters and load research objectives of Jaipur DISCOM.

Function	MV-90	ABB	Visualize-IT	MBSS *
Load Profiling	Y	Y	Y	Y
Rate Design	Y	Y	Y	Y
Cost Allocation	Y	Y	Y	Y
Data Collection	Y	Y	N	Y
Facility Energy Management	N	N	Y	N
Simulation	Y	Y	Y	Y
Statistical Analysis	Y	Y	N	Y
Price			$750	$5000

* Not Windows based

MV-90

MV-90 is a multi-vendor data collection and analysis software and serves as the foundation for Itron/UTS's integrated suite of data collection and management solutions. The Windows-based MV-90 retrieves and processes advanced metering and load profile data for billing, load research, and system engineering applications.

Contact Person: Jack Merrell, Business Development Analyst, Energy Information Systems, Itron,
Phone: (919) 582-1160
Fax: (919) 876-4001
Email: **jack.merrell@itron.com**
Web Page: **www.itron.com**

ABB Energy Profiler

Energy Profiler is an intuitive Windows-based tool for the analysis of energy usage and pricing. It is used for a variety of purposes by load researchers, pricing analysts, utility account managers, major energy customers, and energy services consultants. It is a useful tool for energy usage and pricing analysis.

Rate Design- Energy Profiler can help in rate design. You can compare customer-specific billing determinants and/or interval load data against hourly marginal cost components including generation, transmission, or any other categories.

Price Signals- Energy Profiler allows you to send price signals via email directly to participants in your RTP program.

Data Collection- Energy Profiler can collect usage data directly from any of several popular metering devices.

Compatibility- Energy Profiler can view and edit most popular formats of interval load data, and can collect data directly from devices made by the following manufacturers: ABB, Aptech, GE, Siemens, Schlumberger, and TransData.

Contact Person: Nikki Lopez
Phone: (510)-982-4539
Email: **abbei_info@us.abb.com**
Web Page: **www.energyinteractive.com**

Visualize-IT

Visualize-IT is a Windows application designed to help explore, summarize, and analyze time series interval data. It has been developed specifically for electric and gas load data. It's applications include:

- Class load profiling and rate design

- Reviewing interval load data for large-account billing
- Allocating costs to tenants
- Facility energy management and demand reduction
- Calibrating simulation models
- Interactive graphs that zoom into any period of interest.

The graphs include:

- Average day, average week, peak day, etc.
- All days of any selected month
- Month-to month totals
- Yearly totals of each of your measurements
- Scatter plots relating one variable to another
- Frequency distribution and load duration curves

Rate Calculation

It compares a customer's annual or monthly costs under different utility rates. With the optional Rate Wizard enter new rates, or estimate the class revenue from a rate you design. This powerful tool gives the user a breakdown of monthly costs based upon energy, demand, customer charges and taxes and provides a method of quickly analyzing how energy dollars are being spent. Coupled with Visualize-IT, the Rate Calculator provides a mechanism to analyze the bottom-line cost impacts of operational changes, e.g. those that shift loads from on-peak to off-peak periods.

MBSS

Model based statistical sampling (MBSS) is a statistical methodology for studying a large population by collecting data in a carefully selected sample. For example, in a typical load research study, time-of-use meters would be placed on a sample of accounts to describe the load profile of all accounts in a rate class.

MBSS builds on conventional finite population sampling theory as developed in standard references. MBSS is particularly tailored to applications such as load research directed at collecting highly quantitative information. MBSS is a useful tool if:

- You are interested in the mean or total value of one or more variables describing each unit of a finite population (buildings, accounts, etc.),
- You plan to collect the information in a sample drawn from the population, and

- You have a (usually computerized) list of each unit in the population with limited but relevant information such as some measure of the size of each unit.

Applications

Conventional Load Research: MBSS can be used to design class load studies and to analyze load research data. Class load profiles and confidence intervals can be developed by day type or on an 8760-hour basis. Ratio estimation and related techniques can be used to combine the sample load data with information from your billing system. Model-based stratification controls the distribution of small and large accounts in the sample. Error ratios are used to choose the appropriate sample sizes for each class.

DSM Evaluation. The Engineering Calibration Approach (ECA) usually refers to the use of MBSS to estimate the impact of demand-side management or energy conservation programs, often through onsite auditing or field monitoring. Ratio estimation can be used to estimate realization rates that link the sample data to the tracking information. Data leveraging techniques can be used to combine end use metering in small samples with onsite audits in larger samples.

Contact Person for both Visualize-IT and MBSS: Curt Puckett
RLW Analytics Inc.
1055 Broadway
Sonoma, CA 95476
Phone: (800) 472-6716
Fax: (707) 939-8823
Email: ***curt@rlw.com***
Web Page: ***WWW.rlw.com***

Other Useful Sources of Information on Load Research

- MAISY at **www.maisy.com**
- ENPEP, which was developed by Argonne National Laboratory and the International Atomic Energy Agency, is in use in over 60 countries as an energy-planning tool. In India the contact person is:

  Mr. S.K. Aggarwal
  Central Electricity Authority
  Sewa Bhavan, R.K. Puran
  New Delhi-110066

8. Load Research Workshop

The following program has been planned for two 2-day workshops on load research.

Workshop on Load Research

Bangalore/ Mumbai: May 29 and 30, 2001
Jaipur: June 5 and 6, 2001

Objectives of the workshop:

1. To understand the basic concepts of load research
2. To introduce tools and techniques used in load research
3. To discuss the practical aspects of conducting load research in India
4. To assist the participants in applying the concepts and techniques used in load research to meet Indian utility's strategic objectives.

Day 1

9:00 – 9:30 AM
Registration

9:30 – 10:00 AM
Opening Session

10:00-11:30: Dr. Hameed Nezhad
Load Research Concepts, Process and Applications

11:30-11:45
Coffee Break

11:45-1:00: B. Dixit
System Load Research: Issues, Processes, and hardware

1:00-2:00
Lunch Break

2:00-2:30: Dr. Hameed Nezhad
Load Research Surveys
(Principles of sampling, sample design, size and analysis)

2:30 – 3:30: Jaipur DISCOM DSM team
End-use load research: Jaipur DISCOM Experience

3:30 – 3:45
Coffee Break

3:45–4:30
The role of energy audits in load research (Process and hardware)—PDTC

4:30-5:00
Group Discussion

Day 2

10:00-11:00: State Regulatory commission Rep.
Tariff process, issues, and its impacts on load management

11:00-11:15
Coffee Break

11:15-1:00: Mr. V.M Thakor and Mr. Anand Subbiah
Load research case studies in India

1:00-2:00
Lunch Break

2:00 – 2:30: Mr. Manoj Saha
The role of ESCOs in load management

2:30-3:45
Load research application issues for participating utilities
(One representative from each participating organization)

3:45-4:00
Coffee Break

4:00-5:00
Round-Table Discussions (Q&A)

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9. Meetings Held During this Trip

1. Meeting with Jaipur DISCON CMD

A meeting was held with Mr. Ashok Singhvi, IAS, Chairman and Managing Director of Jaipur DISCOM. The team of consultants introduced the ECO project in general and DSM project in particular. Mr. Singhvi expressed his strong support of DSM activities at Jaipur DISCOM. Also, some of the operational issues at DSM Cell were discussed and Mr. Singhvi promised his strong support.

2. Meeting with Mr. S. Krishnasawamy, Consumer Unity & Trust Society (CUTS)

Mr. Krishnasawamy and one of his staff member visited DSM Cell and discussed consumer issues, particularly those related to rural consumers. We also discussed their role in consumer surveys, particularly for agricultural and domestic consumers and consumer awareness campaign.

3. Meeting with Mr. Dick Edwards, Dr. Ashok Sarkar and Mr. Srinivasan Padmanabhan At USAID Delhi

Dr. Nezhad and Mr. Thakor provided a summary of their activities at Jaipur. Some of the key issues discussed were creating rural cooperatives in Rajasthan to supply power to farmers. Also, changing the focus from DSM to ***Resource Management***, which includes not only electricity, but also other conventional energy sources, renewable resources, as well as water resources.

Appendix A

Consumer Survey Questionnaires

Industrial Survey

1-General Information:

Name of the facility:.....

Name of the facility's director:

.....

Address:

.....

2- what are the products of your facility?

.....

.....

.....

.....

.....

.....

3- Process details: ☐ Continuous: ☐ Non-continuous:

4- Please draw a diagram showing the main processes in your facility?

5- when was your facility established? (Please tick the appropriate answer)

☐ 2000-1995 ☐ 1994-1990 ☐ 1989-1985
☐ 1984-1980 ☐ 1979-1960 ☐ Before 1960

6- Name the date of renovation and expansion plan in your facility if any, explain?
.....

7- Specify daily shifts in your facility

☐ Morning shift ☐ Evening shift ☐ Night shift

8- is there any permanent schedule for maintenance ? If no go to question 12

☐ Yes ☐ No

9- is there a special department for maintenance in the facility ?

☐ Yes ☐ Included in another department ☐ No

10- what is the number of maintenance staff according to their qualification ?

☐ Engineers ☐ Technicians

11- how often do you implement maintenance procedures?(Please Tick the appropriate answers)

☐ Daily ☐ Weekly ☐ Monthly ☐ Yearly

12- what was the ratio of energy cost to production cost in the facility during Previous Year.....%

13- what was the ratio of electricity cost to energy cost in the facility during Previous Year.....%

14- Fill in the following table related to energy consumption for the previous year:

	Energy source	Quantity	Unit	Cost Per Unit	Total Cost (Rs)
1	Electricity				
2	LPG				
3	NG				
4	Fuel oil				
5	Gas/Diesel oil				
6	Kerosene				
7	Benzene				
8	Others (specify)				

15-What is the percentage of energy source used for each end use?

Aim of use	D.O.	HFO (%)	Electricity (%)	LPG (%	NG (%)	Kerosene

Space heating						
Lighting						
Air cond., Ventilation & chillers						
Water heating						
Motors						
Pumps						
Drying						
Air compressors						
Furnaces						
Transportation						
Process heat						
Melting						
Cold storage						
Others (specify)						
Grand total	100 %	100 %	100 %	100 %	100 %	100 %

16- Utility connection details:

Account number:_____

Contract Demant	
Maximum Demand	
Connected Load	

17. Hourly load profile

Hour	Demand (Kw)

18. Monthly load profile

Month	Energy Use (kWh)	Cost (Rs)
January		
February		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		

19. Number of input transformers

No. of Transformers	Loading Capacity

20- Self-generation in the facility ?

No.	Nom. capacity (KVA)	Actual capacity (KW)	Power factor	Efficiency	Type	Hrs. per year	KWh / yr.	Total cost/kWh
1								
2								
3								
4								
5								

21-Are you aware of variable speed drive motor controllers that conserve energy? BIS Motor/Energy Efficient Motor?

☐ Yes ☐ No

22-Did you perform any energy audit in your facility before?

☐ Yes ☐ No

23-Would you like to perform an energy audit in your facility?

☐ Yes ☐ No

24-What are the incentives that would help you to implement energy conservation procedure on your facility from your point of view?

☐ Long term loans ☐ Low- interest loans ☐ No-interest loans
☐ Rebates ☐ Leasing ☐ Reducing taxes and the cha

25- Do you like to train some of your engineers or technicians at a reasonable cost on some of the following subjects:

☐ Motors & its rewinding ☐ Boilers & steam system ☐ Energy auditing
☐ Energy Management System ☐ Automation systems ☐ Economic analysis
☐ Operation & production ☐ Furnaces ☐ Others (specify)

Thank you for your cooperation.

Jaipur DISCOM – Demand Side Management Cell

Commercial & Services survey for energy consumption

1-General Information:.....

Name of the facility or store:.....

Director name of the facility or store:.....

Facility or store address:.....

2- Which of the following types of organizations best describes your organization?

_____ Office building _____ Public _____ Food store
_____ Non- food store _____ Small service (beauty salon..) _____ Restaurant
_____ Laundry _____ Hotel or motel _____ Warehouse
_____ Religious Building _____ Educational institution _____ Hospital/Clinic _____ Theatre _____ Gas station
_____ Other (specify)

3- In which year your facility or store building was structured?

_____ 1999 _____ 1998 _____ 1997
_____ 1996 _____ 1995 _____ 1994-1990
_____ 1989-1985 _____ 1984-1980 _____ 1979-1975
_____ 1974-1960 _____ Before 1960 _____ Don't know

4- How many employees at your facility or store?..... employees

5- Please specify your facility or store working days:

___ Saturday ___ Sunday ___ Monday ___ Tuesday ___ Wednesday ___ Thursday
___ Friday

6- How many working hours per week at your facility or store? ?..... hours per week.

7- Please specify employees number by daily working periods:

From.....o'clock at the morning, to..... o'clock after none..... employees
From.....o'clock after none, to ..... o'clock in the evening..... employees
From.....o'clock in the evening, to..... o'clock at the morning ..... employees

8- What type of building do you work in?

___ Free standing ___ Connected to other building ___ Part of multi-story facility
___ Other (specify)

9- How many square meters is your facility or store area approximately?..... m^2
of which: conditioned..... m^2

10- Does your organization educate its employees on how to conserve energy?

_____ Yes _____ Sometimes _____ No

11- Please check if you have taken any of the following energy conservation measures?

___Improving e.e. of lighting system ___Temperature control ___Improving efficiency of windows
___ Replacing motors with more e-e ___ Heat recovery ___ Others (specify)

12- Are you aware of energy conservation at your facility or store to reduce energy financial expanses?

_____ Yes _____ Somewhat _____ No

13- Is your organization willing to investment in highly energy-efficient equipment assuming that the payback is less than 2 years?
_____ Yes _____ Uncertain _____ No

14- Do you like to train some of your engineers or technicians at reasonable cost on some of the following subjects:
_____ Motors & its rewinding _____ Boilers & steam systems _____ Furnaces
_____ Calculation & EMS _____ Automating systems _____ Economic analysis
_____ Operating & production management _____ No need _____ Others (specify)

15- How significant is your annual energy costs as apart of your annual facility or store expenditures?
_____ Less than 5% _____ Between 5 % -10% _____ Between 11%-15%
_____ Between 16% -20% _____ More than 20% _____ Others (specify) %

16- How significant is your annual electricity costs as apart of facility or store total energy costs?
_____ Less than 10% _____ Between 10 % -20% _____ Between 21%-30%
_____ Between 31% -50% _____ Between 51% -70% _____ More than 70%

17- What is your opinion about current electricity tariff?
_____ High _____ Reasonable _____ Low

18- What is your opinion about future energy prices:
_____ Will not change _____ Will decline _____ Will increase moderately
_____ Will increase substantially _____ Will decline moderately, then increase substantially _____ Others (specify)

19- From the electricity bills during (1999) please specify the following information:
Name of participant. .....
Number of Participant .....
Line No.: .....
Contract demand/Connected load:_____kW

Cycle	First	Second	Third	Forth	Fifth	Sixth	Annual total
kWh							
Cost (Rs)							

20- Fill in the following table related to energy consumption for year 1999:

	Energy source	Quantity	Unit	Cost (Rs)
1	Electricity			
2	LPG			
3	Fuel oil			
4	Gas/Diesel oil			
5	Kerosene			
6	Benzene			
7	Others (specify)			

21- Fill in the following table related to self-generation in the facility ?

No.	Nom. capacity (KVA)	Actual capacity	Power	Efficiency	Type
1					
2					
3					
4					
5					

22- Do you have electric regulator in your facility or store?
_____ Yes _____ No _____ For some equipments

23- Do you have a solar water heating system in your facility or store?
_____ Yes _____ No

24-Do you use solar system for heating water as substitute for D.O. ?
_____ Yes _____ No

25- What can government do to help you conserve energy?
_____ Giving long term loans _____ Giving non interest loans _____ Reducing taxes and the charge dues
_____ Repaying rate of costs _____ Sealing energy saving equipments by soft installment _____ Others (specify)

26- What form of energy conservation advertising do you notice the most? (Put sign ✓ in the square)
_____ Television _____ Newspapers _____ Radio
_____ Advertising pictures _____ Electricity Bill _____ Schools
_____ Portable Loudspeakers _____ Mosques and churches _____ Others (specify)

27- what is the main usage of electricity in your building? (Put sign ✓ in the square)

Aim of use	Kind of used Equipment	Number of end-use Equipment		Number of working hours							
				Summer				Winter			
				Weekdays		Weekends		Weekdays		Weekends	
		Total	Max used at any time	From	To	From	To	From	To	From	To
Conditioning	1 - Ordinary Fan										
	2 - Ceiling Fan										
	3 - Air conditioner										
	4. Water Cooler										
	5 - Others (specify)										
Cooking	1 -Discoid heater										
	2 -Electric cook										
	3 - Microwave										
	4 –Electric oven										
	5 – Others										
Illumination	1 – FL Lamps										
	2 – Incand. Lamps										
	3 Economizing Energy Lamps										
	4. Others (specify)										
	5 -Others (specify)										
Water heating	1 – Electric water heater (giezer)										
	2 – Discoid heater										
	3 -Others (specify)										
Laundry	1 – Ordinary washing machine										
	2 – Half Auto washing machine										
	3 – Full automatic washing machine										
	4 – Drier										
Food preservation	***Defrost refrigerator***										
	1- less than 10 ft^3										
	2- (10-14) ft^3										
	3- (14-16) ft^3										
	4-(4-16 ft^3 & more)										
	No-defrost refrigerator										
	1- Less than 10 ft^3										
	2- (10-13) ft^3										
	3- (14-16) ft^3										
	4- (16- ft^3 & more)										
	Freezer										
	1-Less than 5 drawers										
	2- (6-7) drawers										
	3.(8-drawer & more)										
	Others (specify)										

28- Water Pump information:
Pump Size:_____

Operating Periods:
AM from_____ to _____ PM from_____ to _____

Municipal Water supply Periods
AM from_____ to _____ PM from_____ to _____

Thank you for your cooperation.

Jaipur DISCOM – Demand Side Management Cell

Residential survey for energy consumption

1-Housing kinds (put sign ✓ in the square)

☐ House
☐ Apartment
☐ Others

2-Do you own or rent your residence? (Put sign ✓ in the square)

☐ Own ☐ Rent

3-In which year was this building structured? (Put sign ✓ in the square)

☐ 1999 ☐ 1998 ☐ 1997
☐ 1996 ☐ 1995 ☐ 1994-1990
☐ 1989-1985 ☐ 1984-1980 ☐ 1979-1975
☐ 1974-1960 ☐ Before 1960 ☐ I don't know

4-Approximately how long have you lived in your residence? (Put sign ✓ in the square)

☐ Less than 1 year ☐ Between 1 and 4 years ☐ Between 5 and 8
☐ Between 9 and 15 ☐ Between 16 and 25 ☐ More than 25 years

5-How many square meters is your residence area approximately?.....m^2.

6-How many windows and veranda doors do have in your house /apartment? (Put sign ✓ in the square)

Windows Sized	No.	Windows dirction observed to outside				Material			Glass layer		Shatters	
		S	E	N	W	Wood	Metal	Isolated metal	Single	Double	Wood	Plastic
Small (0.5 x 0.5) m												
Medium (1.5 x 1) m												
Large (2 x 1.5) m												
Veranda door(1 x 2) m												
Others												

7- Information about number of people in the house (put ✓ sign in the square)

No	Sex		Age	Educational level					Working hours outside the house			Working hours inside the house	No work
	Male	Female		Uneducated	Elementary	Secondary	College	Graduate	8	10	14		
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													

8- Do you use D.O. in your house? (Put sign ✓ in the square)

☐ Yes ☐ No

9-What are the main usages of DO in your house?

Kind of Use	Used Equipment	No. Of used Equipment		Number of working hours							
				Summer				Winter			
				Daily		Weekly		Daily		Weekly	
		Primary	Secondary	Primary	Secondary	Primary	Seconda	Primary	Secondary	Primary	Secc
Water heating	Central heating										
	D.O. heater										
	Others										

10-What is the consumption of DO in your house?
Yearly ...Liters

11- Do you use Kerosene in your house? (Put sign ✓ in the square)

☐ Yes ☐ No

12-What is the consumption of the Kerosene in your house?
In winter ...Liters, In summer ..... Liters, Yearly .....Liters

13- Do you use the LPG in your house? (Put sign ✓ in the square)

☐ Yes ☐ No

14-What are the main usages of LPG in your house? (Put sign ✓ in the square)

Kind of use	Used Equipment	No. Of Used Equipment		Number of working hours							
				Summer				Winter			
				Daily		Weekly		Daily		Weekly	
		Mainly	Secondary	Mainly	Secondary	Mainly	Secondary	Mainly	Secondary	Mainly	Secondary
Cooking	Cooker with cylinder										
	Oven with cylinder										
	Cooker with oven for drill										
	Baking oven										
	Small Cooker										
Water heating											

15-How many gas cylinders do you monthly consume in your house?
In winter: ...Cylinders / month, In summer: ...Cylinders / month, Annual consumption: .....
Cylinders / month

16-Do you use electricity in your house? (Put sign ✓ in the square)

☐ Yes ☐ No

17-Does the electricity meter independent or combined? (Put sign ✓ in the square)

☐ Independent ☐ Combined

18- Bimonthly electricity consumption:

Account Number: .....

Cycle	First	Second	Third	Forth	Fifth	Sixth	Annual total
kWh							
Cost (Rs)							

19- Do have electric regulator in your house? (Put sign ✓ in the square)

☐ Yes ☐ No ☐ For some

20- what is the main usage of electricity in your house? (Put sign ✓ in the square)

Aim of use	Kind of used Equipment	Number of end-use Equipment		Number of working hours							
				Summer				Winter			
				Weekdays		Weekends		Weekdays		Weekends	
		Total	Max used at any time	From	To	From	To	From	To	From	To
Conditioning	1 - Ordinary Fan										
	2 - Ceiling Fan										
	3 - Air conditioner										
	4. Water Cooler										
	5 - Others (specify)										
Cooking	1 -Discoid heater										
	2 -Electric cook										
	3 - Microwave										
	4 –Electric oven										
	5 – Others										
Illumination	1 – FL Lamps										
	2 – Incand. Lamps										
	3 Economizing Energy Lamps										
	4. Others (specify)										
	5 -Others (specify)										
Water heating	1 – Electric water heater (giezer)										
	2 – Discoid heater										
	3 -Others (specify)										
Laundry	1 – Ordinary washing machine										
	2 – Half Auto washing machine										
	3 – Full automatic washing machine										
	4 – Drier										
Food preservation	***Defrost refrigerator***										
	1- less than 10 ft^3										
	2- (10-14) ft^3										
	3- (14-16) ft^3										
	4-(4-16 ft^3 & more)										
	No frost refrigerator										
	1- Less than 10 ft^3										
	2- (10-13) ft^3										
	3- (14-16) ft^3										
	4- (16- ft^3 & more)										
	Freezer										
	1-Less than 5 drawers										
	2- (6-7) drawers										
	3.(8-drawer & more)										
	Others (specify)										

21-What are the other Electric equipments used in your house? (Put sign ✓ in the square)

Kind of used Equipment	Number of used Equipment		Number of working Hours			
			Daily		Monthly	
	Primary	Secondary	Primary	Secondary	Primary	Secondary
1. Color TV						
2. B&W TV						
3. Iron						
4. Vacuum						
5. Dish washer						
6. Video						
7 Hair drier						
8. Blender						
9. Radio						
10. Recorder						
11. Stereo						
12. Water cooler						
13. Computer						
14. Others (specify)						

22-Do you have a solar water heating system? (Put sign ✓ in the square)

☐ Yes ☐ No

23-Do you use solar system for heating water most of the time? (Put sign ✓ in the square)

☐ Yes ☐ No

24-Do you use solar system in addition to electricity and D.O. for heating water? (Put sign ✓ in the square)

☐ Yes ☐ No

25-How significant is your annual energy costs as a part of your annual household expenditures? (Put sign ✓ in the square)

☐ Less than 5% ☐ Between 5 % - ☐ Between 11'
☐ Between 16% - ☐ More than 20% ☐ Others (spec

26-How significant is your annual electricity costs as apart of all energy forms expenditures? (Put sign ✓ in the square)

☐ Less than 10% ☐ Between 11% - ☐ Between 21'
☐ Between 31% - ☐ Between 51%- ☐ More than 7'

27-Are you interested in reducing and conserving electricity consumption in your house? (Put sign ✓ in the square)

☐ Yes ☐ Somewhat ☐ No

28-What form of energy conservation advertising do you notice the most? (Put sign ✓ in the square)

☐ Television ☐ Newspapers ☐ Radio
☐ Advertising pictures ☐ Electricity Bill ☐ Schools
☐ Portable Loudspeakers ☐ Place of Worship ☐ Others (specify)

29-Do you feel that energy conservation will reduce your energy cost? (Put sign ✓ in the square)

☐ Yes ☐ Somewhat ☐ No

30-Are you willing to pay for the energy- saving equipment? (Put sign ✓ in the square)

☐ Yes ☐ Uncertain ☐ No

31-What can Government do to help you conserve energy?

☐ Giving long term loans ☐ Giving non interest loans ☐ Reducing taxes and the cha

☐ Repaying rate of costs ☐ ☐

32- What is your opinion about current electricity tariff? (Put sign ✓ in the square)

☐ High ☐ Reasonable ☐ Low

33- Water Pump information:

Pump Size:_____

Operating Periods:

AM from_____ to _____ PM from_____ to _____

Municipal Water supply Periods

AM from_____ to _____ PM from_____ to _____

Thanks for your cooperation.

Jaipur DISCOM – Demand Side Management Cell

Agriculture Sector Survey

1. General Information

District:_____

Block:_____

Gram Panchayat:_____

Village:_____

Customer Name and Address:_____

2. How Customer is using electricity ?

- Sanctioned Load – KW/HP:

End Use	Rating [KW]	Daily Use Hrs.	Time of Use
Pump			
Lighting			
Fan			
Electric Heater			
Refrigeration			
TV			
Others {Specify}			

3. Farm information

Agriculture Area ---------- Acre/Bigha
Type of Crops:_____
No. of Crops per year:_____

4. Tariff Type: ☐ Meter ☐ Flat Rate

5. Pump Set Details:

1. Pipe Size
2. Pipe Type
3. Foot Valve
4. Do you have storage tank ? ___Yes ____No
5. Irrigation System : ___ Drip Water
   ___Sprinklers
   ___Direct

6. Water level Depth _____

7. Motor Information

1. Motor Type and Manufacturer:_____
2. Motor Label: ---ISI ___NON ISI
3. Motor Efficiency: _____
4. Size of Motor:_____KW
5. Age of Motor:_____Years
6. Number of Rewinding done since purchase:_____
7. Type of motor starter:_____
8. Are Capacitor installed? ____ Yes ____No
9. Are you using single phase? ____Yes ____No

8. Power Supply Information:
   1. Voltage Range:_____
   2. Period of supply: _____
      i. Single Phase: From ____AM to _____ AM and from _____PM to _____PM
      ii. Three Phase: From ____AM to _____ AM and from _____PM to _____PM
   3. Actual hours of supply:
      i. Single Phase: From ____AM to _____ AM and from _____PM to _____PM
      ii. Three Phase: From ____AM to _____ AM and from _____PM to _____PM
   4. No. of interruptions Per Day:_____

9. Cost of Power:
   1. Cost of Power as a % of total farm operating costs:
      Annual Cost of Power:_____ Rs
      Annual Cost of Labour:_____ Rs
      Annual Cost of Water:_____ Rs
      Annual Cost of Others:_____ Rs

10. Are you willing to pay meter - supplied power with guaranteed availability?
_____Yes _____No _____Not Sure

11. Have you taken any energy efficiency measures? If yes, please gives us detail

12. What are the key power supply issues ?
____Availability _____Reliability _____Quality

13. What are the optimum times for power supply?

From ____AM to _____ AM and from _____PM to _____PM

14. Do you have diesel pumps? _____Yes _____No
If yes, size _____
Cost [Fixed] _____
Operating Cost per Hour _____
Hours of Operation _____

15. Do you have a generator? ____Yes _____No
If yes,
Generator type:_____
Capacity:_____
Cost [Fixed]
Cost [Operating Cost per hour]
Hours of Operation per day.