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Assessment of Barriers and Implementation Strategies for DSM Programs in Restructured Indian Electricity Scenario: A Case of Rajasthan Power Sector

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ABSTRACT

India is experiencing power shortages both in terms of peaking and energy. There is a critical need for a vigorous demand side management (DSM) program to supplement capital-intensive supply side options in bridging the demand and supply gap in the short run. Widespread implementation of DSM in Indian utilities is a major challenge facing both institutional and administrative roadblocks. Government of India is making efforts through different policy measures to encourage DSM. Despite the large energy saving potential and clear economic benefits, utilities are hesitating in widespread implementation of these programs. The most common barriers for implementing DSM include non scientific tariff, lack of incentives, lack of information, and absence of integrated planning approach, etc. Using the Rajasthan power sector as a case study, this paper identifies and examines the major barriers through a series of in-depth interviews with the top utility officials of Rajasthan. Finally, the paper suggests suitable policy measures for removing these barriers.

1. INTRODUCTION

India's power industry is characterized by inadequate and inefficient power supply with peak capacity and energy supply shortages estimated to exceed 12% and 9% respectively [1]. The bulk of capacity additions in India's power supply are expected to come from coal-fired stations supplemented by hydroelectric power development and medium-sized diesel or naphtha-based plants. Due to the shortage of fossil fuel resources and the awareness of the air pollution problem, which is produced by the use of fossil fuel, the Indian government has tried to solve these problems through promoting end use efficiency measures in electricity sector.

Demand Side Management (DSM) has emerged as a successful approach for promoting utility energy efficiency programmes. While addressing end-use efficiency, DSM also applies to utility concerns such as capacity and energy shortfalls, transmission and distribution losses [2]. According to the study conducted by Nadel and Kothari [3], nearly 30,000 MW could be saved through the implementation of energy conservation programs. Studies and experience have indicated that most of India's negawatt potential can be captured at substantially lower costs compared to the cost of capacity additions, which currently stands at over US $1 million per MW [4, 5]. A recent study conducted by TERI and CERI has estimated DSM potential of 19500 MW by year 2021 [6]. However, in spite of good returns and short payback periods for energy efficiency investments, most of India's end-use energy efficiency potential remains largely untapped. Energy conservation and efficiency improvement in the Indian power sector requires special attention since the sector has been suffering from a chronic

supply shortage, lack of capital investment for new capacity addition and environmental problems associated with coal-based power plants [7, 8].

The importance of DSM is well recognized in developed countries [9-11]. Even though the majority of studies have been carried out in the developed countries, only a few have addressed the issue in developing countries. The government of India, through new energy conservation legislation is seeking to implement a host of such programmes within the country. One of the key elements of the DSM programmes is the introduction of rational cost-of-service based tariffs for power within the country [12]. Although DSM has the potential to improve customer service, utility profitability, and operational efficiency, neither the central nor state governments have been in a position to provide rebates or other direct incentives for DSM.

Many utilities in India have tried to explore this potential through pilot demonstration programs, but there have not been significant achievement so far. The existence of untapped energy savings potential indicates that current market conditions do not favour the implementation of DSM programs. There is a need to increase understanding of the implementation issues of DSM by government, regulators and utility officials for designing appropriate policies for effective implementation of DSM programs.

The paper is based on a USAID sponsored consultancy project entitled "Regulatory implementation of IRP/DSM in Indian utilities". One of the authors (Sanjay Vashishtha) was part of four member team to conduct the study. The objective of the study was to analyze the salient issues that need to be addressed in order to facilitate DSM in newly formed distribution companies (Discoms) as well as recommend possible policy measures under the current structure of the utility. Rajasthan power sector was taken as a case study to assess various institutional and administrative barriers for DSM.

The paper is divided in to five sections. First section, addresses the significance of DSM. In section 2, the institutional structure of Rajasthan power sector before and after restructuring have been analysed. Section 3 discusses the methodology of the experts survey conducted. Section 4 discusses the results of the study and recommendations and conclusions are drawn in final section.

2. INSTITUTIONAL STRUCTURE

Rajasthan power sector has undergone significant changes in recent years, and the institutional framework evolved to supply electricity had to adjust to changing scenario. Rajasthan was the one of the few states in India to implement a comprehensive power sector reform programme [13]. Prior to reform, the responsibility for power sector management and development in Rajasthan was vested in the following organizations:

- Department of Energy, Government of Rajasthan;
- Rajasthan State Electricity Board (RSEB).
- Rajasthan State Power Corporation Ltd. (RSPCL)

However, RSEB was the main body responsible for power sector development in the state. RSEB was owned by the Government of Rajasthan and vested with the responsibility for regulation and supply of power to the entire state of Rajasthan. RSEB obtained the required power for distribution either from its own generating stations, or from other power generators. By using its transmission and distribution network is used to supply power to the end users.

The process of power sector reform started in 1999, when the Government of Rajasthan approved the Power Sector Reforms Bill, 1999 [14]. On July 19, 2000, under an agreement arrived at with the World Bank for a loan of US $180 million for the Rajasthan power sector-restructuring project [15]. The RSEB was dissolved and five new companies were set up in its place. An independent regulatory

body, Rajasthan Electricity Regulatory Commission (RERC) was set up to regulate the power purchase, tariff, promote transparency, efficiency and economy in the operation and management of these power utilities.

A comparison of the structure of Rajasthan power sector before and after reform is given in Table 1. Role of state government is limited only for policy decisions. The newly formed regulatory commission is responsible to take decisions in fixing tariff issues, promoting the efficiency etc. The Rajasthan Vdyut Utpadan Nigam (Genco) is responsible for generating power from all the existing generating stations of RSEB and complete the projects under commissioning by RSEB. The Rajasthan Vidyut Prasaran Nigam (Transco) purchases power in bulk from Gneco and other generating stations, both central and private power producers within and outside Rajasthan, and the neighboring states based on legally binding power purchase agreements. The Transco is also responsible for overall system planning and coordination. The State is geographically divided into three Discoms namely Jaipur Vidyut Vitaran Nigam, Jodhpur Vidyut Vitaran Nigam and Ajmer Vidyut Vitaran Nigam. These companies approach the regulatory commission individually for fixing their retail tariffs. Discoms purchase electricity on the basis of bulk sales agreements from Transco at a flat rate of 2.17 Rs./kWh, which is further sold to the end-users in the state at different tariffs

Table 1 Institutional framework of Rajasthan power sector before and after restructuring

Activity	Pre reform (before July 2000)	Post reform (after July 2000)
Policy making	Government of Rajasthan	Government of Rajasthan
Regulation	RSEB/ Government of Rajasthan	Rajasthan Electricity Regulatory Commission
Generation	• RSEB owned power plants • Captive plants • Rajasthan Energy Development Agency • Other purchases	• Rajasthan Vidyut Utpadan Nigam • Captive plants • Rajasthan Energy Development Agency • Other purchases
Transmission	RSEB	Rajasthan Vidyut Prasaran Nigam
Distribution	RSEB	• Jaipur Vidyut Vitaran Nigam • Ajmer Vidyut Vitaran Nigam • Jodhpur Vidyut Vitaran Nigam
System planning and coordination	RSEB	Rajasthan Vidyut Prasaran Nigam
Tariff structure	Agriculture and domestic consumers subsidized by industry and commercial consumers	• Agriculture and domestic consumers subsidized by industry and commercial consumers. • Subsidy will be removed in phased manner

3. METHODOLOGY OF THE STUDY

Since the objective of the study was to obtain a contextual understanding of the factors responsible for the DSM implementation, in person survey was considered as an appropriate method. For the purpose of this study, 20 top officials of various organizations were selected as samples for data collection. Since the study is targeting key policy makers, therefore the judgmental sampling method was adopted while selecting sample. Experts selected for interview were top management officials of RERC, Transco, Discoms, Department of energy, Government of Rajasthan and some independent consultants in the state.

The semi-structured interview style was chosen because it allows the respondent to speak in his or her own words on the topic of interest and allows the interviewer to adapt the interview to capitalize on the special knowledge, experience or insights of respondents. Because these individuals were located in different organizations, prior appointments through telephone or fax were taken to conduct the interviews. The interviews were conducted during June 2003. The interviews lasted for an average of one hour. The questions in interviews covered broadly the DSM implementation issues, which are as follows:

- Who should be made responsible for planning and implementation of DSM under the current structure?
- What are the pros and cons for implementing DSM programs through existing utility framework?
- Are tariff reforms necessary for implementing DSM?
- Who should be responsible to carryout IRP under the current framework of the utility?
- What are the disincentives for utility to implement DSM?
- What mechanisms the regulators should adopt to maximize a utilities DSM results?
- Does the utility staff have enough expertise for monitoring and evaluation of DSM programs?

4. RESULTS AND DISCUSSIONS

A brief discussion on the salient aspects of the responses given by the utility officials and independent experts with respect to specific issues of DSM implementation is attempted in this section.

4.1 Need for an integrated approach to power planning

The planning process of the electricity sector in Rajasthan is currently being performed at various agencies within the State like Genco, Transco, Discoms, Department of Power, etc. Further, they are closely influence by the policy measures implemented from time to time by various agencies of Government of India like Central Electricity Authority (CEA), Ministry of Power as well as power producers like National Thermal Power Corporation (NTPC), etc. According to the current understanding, the Discoms and Transco are responsible for secure supply today and in future. But one important question is to what extent they should be hold responsible for it, and what should be the cost of secured quality power supply to the consumers?

The experts unanimously agreed that the major barrier in DSM implementation is due to the deficiency in the planning system. Currently there is no central agency to develop an integrated resource plan at state level. Under the current framework, utilities are finding it very difficult to integrate the supply-side and demand-side options simultaneously through an integrated resource planning (IRP) approach. In current structure where the functions of the electricity industry have been unbundled into separate businesses, IRP can be undertaken in the natural monopoly elements of the industry, i.e. the Transco and Discoms. These utilities, while sourcing new supply options should evaluate the supply-side project's merit relative to demand-side options.

4.2 Lack of Institutional mechanism

Discoms are seen as a natural choice to implement DSM, as they have advantage of consumer contact, established consumer relations, a billing system and a delivery capability within the state. But, currently these Discoms do not have any institutional mechanism who can take up the task for implementing the DSM programs. Some Discoms have recently formed a DSM cell with limited resources and expertise to take up the DSM promotional activities. But still they are unable to handle the large scale DSM programs. Experts emphasized on the need of developing private sector capabilities through

ESCO market development. It was also recognized that private sector development would not occur naturally, and a market that is conducive to DSM should be created first by the Discoms.

4.3 Lack of Expertise

The newly formed DSM Cells in Discoms lack both expertise as well as the manpower required to kick start a DSM activity. Such cells were formed with the assistance of international donor agencies, and as could be expected, consisted of existing staffs from other groups. Since the philosophy of DSM, namely working with the consumer, was alien to traditional SEB culture, an urgent need exists for the DSM cells to be educated in the areas of customer contacts, end use technologies and expanding their perspectives to system scale rather than their narrow job descriptions. A rapid progress can be made on both fronts, if additional staff with experience in customer-oriented industries could be hired. The training should be focused and persistent with opportunities for field exercises.

Regulatory commission's staff also needs DSM oriented training and expertise. This was evident when one of the member of the regulatory commission expressed his opinion that with almost a flat load curve of Rajasthan system, there was no scope for DSM, while it is the fact that flat load curve had been achieved by limiting the power supply to agriculturists and load shedding that cannot be considered as regular DSM measures. Further even with flat load curve energy conservation through DSM is still feasible.

4.4 Non scientific tariff

The social commitments and political compulsion of the State Government resulted in setting under-priced electricity tariffs extending heavy subsidy to domestic and agricultural sectors. The average rate of electricity supply is about 3.45 Rs./kWh, while the average cost of purchases is about 2.17 Rs./kWh for Discoms. Experts interviewed in the study opined that the under-pricing of electricity is the major barrier to DSM implementation. They recommend to implement a rational and scientific tariff structure, avoiding under-pricing and letting the price reflect the real cost, which will not only improve the financial health of the utility, but will also act as an effective tool for efficient use of energy.

4.5 Lack of incentives to utilities

At present, there is no mechanism by which utilities are induced to increase efficiency through a system of rewards or penalties. Traditional regulation provides strong incentives for avoiding conservation or DSM investments. For example investment in supply side is easier to recover than investment in conservation. Cost recovery is also easier for supply side investments. Most significant savings potential exists in agriculture and domestic sector through pump efficiency improvement and lighting efficiency DSM projects, but recovery of capital investments made in these consumer categories is difficult to utility and financial institutions.

Under the current framework, Transco purchases electricity from IPPs, State owned Genco, and central owned power companies (NTPC, NHPC etc). The tariff paid by the Transco against these purchases are based on ABT tariff, but the electricity sold to Discoms is at a flat rate i.e. 2.17 Rs/kWh irrespective of any hr of the day or day of the year. The fixity of the price erases any incentive for Discoms to be alert for building strategic load shape under the principles of DSM.

When we argued that, when the Discoms are not able to recover their costs fully, as average cost of supply is higher than average tariff. DSM can provide a means for mitigating that loss. The utility officials told that, in case of subsidized consumers (Agriculture and Domestic) promoting DSM may save their subsidized amount, but the saved electricity will go again to the subsidized consumers only rather than diverting it to non subsidized consumers and generating higher revenues. This leads to a net loss to utility in terms of expenses made against the DSM promotion activities.

Experts noted that short-term profit considerations motivates utility managers to increase sales, conservation poses a threat of revenue erosion, which in turn threatens earnings. For example there is a fairly good savings potential exists in industrial sector through different DSM measures. Funding for these projects can easily be made available through financial institutions in terms of tri parry agreements or equipments leasing, etc. There are little incentives to utility to reduce consumption by industrial consumers who are their best paying consumers.

4.6 Lack of essential information

Utilities do not have sufficient information about the end use consumption of electricity at the consumer's end. Two type of end use information is essential for structuring a cost effective DSM program. The first is the information on existing end use technologies in use by customers and the second is the time patterns of energy use called load shapes. The usual process for updating these data is customer surveys and load research on statistical samples. Both databases need to be built, but frankly, the cost and time commitments would be significant. In the mean time, it is recommended that standard performance and cost data on available end-use technologies be collected from multiple sources and disseminated widely on computer readable media such as a data CD. Maintenance of such data in timely manner will be essential to keep up with changes in technology markets and consumer preferences.

4.7 Lack of Finances

Poor financial conditions of the Discoms do not allow them to make investments in large scale DSM programs. To finance the EE and DSM activities, a dedicated fund may be raised through a special levy for DSM applied on consumers of electricity per unit of electricity sold. Furthermore, the administration of the funds can be made by utility with regulatory oversight.

5. SUMMARY AND RECOMMENDATIONS

- The natural implementation of DSM under the current framework can be achieved, if responsibility of DSM implementation is given to an entity that will have no financial losses even if electricity losses are reduced. ESCOs can be an effective means for creating a natural DSM framework. The ESCOs install the energy efficiency measure and take full responsibility of its proper functioning. The ESCOs are only paid for the savings realized as per the performance contract. The states which has already implemented (e.g. Surat electricity company, Ahmedabad electricity company.), it appears performance contracting can survive on its own. In this situation no government organization is needed for promoting energy efficiency. But larger savings exists in the agriculture and domestic sectors where these measures may not be feasible, or the ESCOs may not be interested due to high risk of recovery of their expenditures.
- Utilities should develop their own DSM plans so that they could trade with a wide range of potential suppliers (e.g. IPPs, Genco, Central sector suppliers such as NTPC, NHPC, etc) and consumers (through DSM) as well as develop their own resources (savings through T&D loss reduction) according to a least cost planning methodology. According to this idea Discoms should present an amount of energy and power to be purchased by Transco, at a reasonably acceptable price. Of course it should be the starting point for negotiations and reassessments of Discoms position, but behind that proposal a full internal analysis using integrated resource planning should be done, with different alternatives for trade with Genco and other suppliers as

well. In such a scenario the role of generating companies will be limited and they have to provide electricity at competitive rates.

- One important issue in electricity act 2003 [16] is the possibility of Discoms to finance investment in supply capacity development. It could co invest in new generation projects. A Discom utilizing IRP would be able to structure their contracts with traders to meet their cost, energy demand and flexibility requirements. The flexibility aspect should be emphasized because the current utility operations are hamstrung, as was mentioned earlier, by rigid supply arrangements with Transco, thus limiting their ability to exploit market opportunities as available.
- Present tariff does not provide appropriate signals to consumer for shifting towards conservation. The subsidized rates also lead for inefficient usage of electricity by these consumers. Until the subsidy is removed it is very difficult to promote DSM in these consumers. There is a necessity of tariff reforms to improve prospects of DSM.
- Without differential tariff between peak and off-peak periods, there is no enthusiasm for Discoms for implementing DSM measures. The unfortunate situation gets worse. While Transco does face the market price variations, they have none of the qualifications for implementing DSM- they are arms- length removed from retail customers, Discoms being their only customers.
- In order retain a successful framework for DSM implementation, the utility should be ensured for proper incentives by financial compensation. Another alternative is that the government can make it mandatory to achieve certain energy efficiency goals. But the major barrier is due to the fact that imposing IRP on each of these utilities would always reduce their overall revenue.
- Utility and consumers do not have enough experience with proven cost effective energy-saving measures. As a result the end users perceive energy efficiency technologies to be unreliable, particularly if they have not installed the measure. Further the end users are reluctant to adopt new, innovative technologies due to their performance uncertainties and fear for a possible disruption in routine caused by the implementation of energy efficiency measures. There is a need to develop pilot demonstration projects to build confidence of consumers in terms of reliability and performance of energy efficiency technologies.
- Energy conservation cell/ DSM cell should be set up in all the utilities where they do not exist at present. Initially these cells could start with information dissemination activities by organizing workshops, meetings with consumer's forums.
- The institutions like Bureau of energy efficiency (BEE) should institute and conduct the testing of all electrical appliances to determine their energy efficiency ratings.
- Ongoing DSM experience of other utilities in India also needs to be quickly collected and disseminated. Generally, an informal but professional newsletter can fill this void until more organized process could be adopted.

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