CHAPTER- 5

DEMAND - SIDE MANAGEMENT STRATEGIES FOR

HARYANA STATE

In the previous chapter, while preparing the integrated resource plan for Haryana state, we have found highly cost effective energy efficiency potential exists in household and agriculture sectors in the state. But existence of such a large and cost-effective saving potential indicates that there are a number of barriers which inhibiting the consumers to switch over to energy- efficient appliances in the state. In this situation, of course, it is for the government, utility and other institutions to bring energy efficiency to the reach of the customers and also promote some demand side management (DSM) strategies for effective implementation of energy efficiency measures. These strategies imply the elaboration of programmes, which consist of a series of coordinated actions targeting specific ends. DSM programmes represent a collection of demand side measures and policy instruments that may be used to implement them in a systematic way. But the DSM is new concept in the country. Therefore, strategies are not yet fully developed or well understood. Presently, the situation is that even if a decision maker is thoroughly convinced of the importance of DSM, very few approaches are available to him or her that help
formulate implementable DSM programmes. Utility planners also lack expertise in evaluating the DSM programmes.

In view of above, this chapter has been devoted to brief review the barriers to DSM in Haryana state with a view to seeking mechanisms and/or strategies to remove, or at least reduce these impediments in order to promote energy-efficient and eco-friendly measures in the state.

The chapter has been divided in two sections. Section-5.1 deals with the analysis of the various DSM barriers in general. In Section 5.2, we have described the role of various stakeholders i.e. the utility, government, regulators and non-government agencies in overcoming the barriers and in promoting the diffusion of energy efficient measures in the state. Finally, we have also discussed some DSM strategies for agriculture sector, which may be implemented through energy service companies (ESCO’s) to realize the DSM potential in the state.

SECTION 5.1: BARRIERS TO DEMAND - SIDE MANAGEMENT

The main barriers inhibiting the consumers/utility to switch over to the energy-efficient appliances have been identified by some existing studies\(^1\) which are reviewed as under.

a. Lack of Proper Electricity Pricing

Theoretically, straightforward economic analysis demonstrates that selling electricity at the long run marginal costs (LRMC) may produce optimal results because the utility may receive revenues to cover the cost of the marginal resources needed to supply the amount of electricity that consumers are willing to buy. But as already stated that electricity price in Haryana, like other states of India, is not based on LRMC. Instead, this price is based on average cost. There are several reasons of this divergence from economic theory, including some technical, some social and some political. Electricity in the state has been subsidized to domestic and agricultural sectors to the levels below the average cost of supply. While this practice has been justified in terms of reducing the price of electricity to, say, low-income users, the effects have been counter-productive. The huge subsidies have completely distorted the economics of energy use in these sectors. It may be argued that where subsidies are the greatest; the wastage of electricity is also the greatest. At low energy prices, combined with other barriers, the energy users would invest little in energy efficiency measures and electric utilities would have to invest far more. This would lead to increase in society’s overall costs for providing electricity.
Another practice in the state has been the use of subsidies across consumers, which may be one reason for the lack of enthusiasm for adopting efficient practices even in most promising areas. The industrial and commercial sectors have been for long subsidizing the politically sensitive domestic and agricultural sectors, which has made these customers apathetic to the notion of savings in electricity bills through to end-use energy efficiency. The huge subsidies to these sectors have also made the utility financially bankrupt and heavily dependent on the revenues from the industrial and the commercial sectors. This factor keeps even the utility disinterested in promoting efficiency in these higher tariff sectors, which are its biggest revenue source.

**b. Information Barriers**

Lack of knowledge on the part of consumers, vendors, manufacturers, and policy makers has also hampered the introduction of energy efficient measures in situations where they make technical and economic sense. Majority of domestic and agricultural consumes in the state are still not aware of alternative technologies available, their costs and savings. In agriculture sector, generally the local technician advises the farmer about the system design. But, often, the lack of the technical competence of these technicians leads to improper configuration of the pump sets i.e. size of pump, pipes etc. Whereby the efficiency of the system, as a whole has remained quite low. The
same can be said of commercial and industrial customers faced with other business pressures.

Lack of information and poor information dissemination has also been found important barriers to DSM at the utility level. Often the utilities do not gather appropriate technical and financial information on the operation of their distribution networks and end-use energy consumption patterns of their consumers etc. Without this information, it may be very difficult to assess the potential and the economic (and financial) viability of DSM measures, or comparing the cost-effectiveness of DSM spending with new supply side investments. In case where such information was collected, it has been often of such poor quality that it could not be used. To aggravate this situation, distribution utilities were not fully informed about different DSM opportunities, methods and tools, their benefits and costs and how they could be implemented.

c. Financial Barriers

Higher initial costs of certain efficient measures may be an important barrier to DSM programme implementation. The measure might be very cost-effective with fast pay back, but it may not be implemented unless the consumer meets its initial costs. Various studies also establish the fact that even when efficient measures are available, and are apparently cost effective,
people overwhelmingly prefer the measure that offers a lower initial cost. It may also be said that the initial costs are not only restraining financial factor, in some cases a customer may have capital, but energy efficiency may not have his priority for investment. For instance, an industrial customer may prefer to invest on a new line of products rather than consider a retrofit in existing installations. Thus, only effective DSM strategies may address these specific issues.

d. Institutional and Legal Barriers

These barriers frequently start within the power utility. The traditional planning mindset tends to associate greater credibility with highly centralized power production centres and does not favour investments in energy consumption measures or decentralized options of electricity production. Legal barriers also frequently limit the scope of the planning activities of the utility. For example, the electricity companies are usually legally defined as being responsible for supplying electricity only and are required to make investments only in the power supply.

Legal accounting procedures also impede utilities from considering investments in their consumer’s facilities as part of the utility investment and therefore, such investment has not be taken into consideration when tariff rates

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are calculated. Thus the institutional and legal barriers together impede tariff rates that allow utilities to recover its costs of DSM programmes.

e. Split Incentives

Sometimes the person who pays the energy bill is not responsible for the selection and purchase of energy-using equipment. This is especially the case for buildings, where architects, builders and landlords select building designs and equipment, but buyers pay the energy bills. Thus, they have no economic incentives to incorporate design features that would improve the availability of daylight, or install lighting fixtures, control systems, etc. that would increase the efficiency of electric lighting. An analogous case exists for rented building where tenants who generally pay for electricity may be unwilling to make capital investments in a building they do not own. Energy-efficient building design and construction may be promoted through design incentives and building energy consumption standards.

f. Technological Barriers

Product availability and its ongoing technical support is also an important factor in order to sustained market for the efficient technologies being introduced. Otherwise lack of maintenance and support may constitute a barrier for success in implementing the demand side management options.
SECTION - 5.2: OVERCOME THE BARRIERS

We have seen in the preceding section that the barriers mentioned above are often inter-related and it is generally the combined effect of a number of these barriers that actually prevents the switch to energy-efficient appliances or makes it an uninteresting proposition to most of the customers. Therefore, the removal of particular barriers may be a necessary condition for DSM investment, but this may not enough. There are certain key barriers more particularly those of economic and technical nature, which have to be overcome to create sufficient conditions for DSM investment. For this, it is necessary for the utility, governments and regulators to intervene and encourage some strategies in order to promote the required significant changes in consumer behavior and effective implementation of energy efficiency measures with some incentives.

Thus, all of these stakeholders have different roles to play in overcoming these barriers, which is briefly discussed as under.

A. ROLE OF THE GOVERNMENT

The government has an important catalytic role in promotion of energy efficiency through various economic and financial instruments and policies that
would encourage large-scale electricity end-use efficiency. Possible steps that may be initiated by the government in this regard are as under:

I. Policy Initiatives

a. Augment the concept of Integrated Resource planning in the power sector-planning framework.

The successful implementation of end-use efficiency measures requires that government must gave emphasis on power planning based on integrated resources planning (IRP) analysis wherein investments in energy efficiency by the utility is considered as a feasible alternative. The first step in this direction may be to create an appropriate institutional mechanism to build the capability of electric utilities to undertake IRP and to establish programmes to encourage energy savings. The second step may be to help utilities in identify and undertake an initial set of end-use efficiency investments, to give them experience in administering end-use efficiency programmes and demonstrate to them that such investment may have high returns.

b. Awareness Programmes on Energy Efficiency.

For the success of any programme, active participation of the end user is very important. Therefore, awareness creation programmes by the government may be organized to educate people on energy efficiency. While there are ongoing efforts by several organizations, there is a need to consolidate these efforts in order to ensure that there may be a maximum outreach.
However, various studies have shown that information programmes work better when attached to other initiatives (such as pricing) and other programme such as rebates, energy audits or performance standards etc.\textsuperscript{3}

In addition to it, the government may initiate demonstration projects in high priority areas such as lighting and retrofitting of agriculture pump-sets by providing the necessary financial impetus for such programmes to take off. The government may also serve as a role model by adopting energy efficiency practices in prominent Govt./ public buildings, offices & residential colonies that may have a multiplier effect.

c. Introduction of the Efficiency Standards.

Standards may be introduced for new appliances, materials and buildings. However, International experience shows that standards may be useful in situations where energy efficiency improvement cannot be achieved otherwise \textsuperscript{4}. Thus, a combination of other programmes such as loans, rebates and information may also be used in conjunction with standards to create a market for these products and help minimize the impact on consumer’s budgets.

\textsuperscript{3} Nadel, S., M. W. Reed, D. R. Wolcott, 1994 (eds), " Regulatory Incentives for Demand- Side Management," Research Report, ACEEE, Washington, DC. P.112

\textsuperscript{4} Terry Oliver, 2001, Global energy efficiency and renewable energy policy options and initiatives, Energy for Sustainable Development. Vol. V, p-16
II. Economic and Financial Instruments

a. Rationalizing Electricity Pricing.

As already stated, energy subsidies have produced wrong economic signals to the consumers. In view of this, there is a need to rationalize the electricity price policy. One possibility may be to shift the subsidy towards the purchase of energy-efficient products. This practice may reduce electricity demand growth and overall costs to the society.

b. Restructuring Taxes and Duties in the Power Sector.

The government may help in creating a market for more efficient technologies using fiscal policies and allowing for more financial incentives (tax reduction) for more efficient technologies and/or increase taxes for the less efficient ones.

B. REGULATORY EFFORTS

Regulations, which often complements/supports a legislative framework as well as allows for a greater degree of public involvement and pragmatism, has also been widely used to ensure investment in DSM in many countries. The regulatory framework used in the US for this purpose is illustrative of this. In US, the utilities were pushed by their regulatory commissions to adopted IRP in order to identify and capture the potential for

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5 Nadel, S., M. W. Reed, D. R. Wolcott, 1994 (eds), op. cit. P. 151.
cost effective energy-efficiency improvements. The efficiency measures were implemented by the utilities through DSM programmes. US regulators have also allowed utilities to recover lost revenues and costs in addition to permitting utilities to make a small profit on energy efficiency programmes. Costs and revenue losses were essentially built into prevailing tariff structures. US regulators were of the opinions that since utilities were permitted to earn a "reasonable" rate of return on supply-side investment; the same should apply to demand-side investments. Thus, regulators adopted various financing mechanisms to enable utilities to partially and/or fully recover costs and lost revenues associated with DSM programmes. In addition to making the above mechanism viable to the utilities, regulators also incentivise DSM programmes through shared-saving mechanism, mark-up mechanisms (rewards on a programme basis) and bonus mechanisms (rewards on a per unit energy saving basis).

Thus, experience with a combination of additional incentives and decoupling⁶, the US has shown clearly that regulatory reforms may rapidly change the strength and scope of utility driven DSM programmes.⁷

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⁶ Mechanism that addresses this bias by eliminating the link between energy sales and utility profits are referred to as decoupling.

In India also, the regulators may play a significant role in promoting the end-use efficiency in the same way. Here, the regulatory commissions are expected to ensure, before approving the new investments, that integrated resource plan exercises be carried out by the utility. In terms of which comprehensive evaluations of all the economic, social and environmental implications of all feasible supply and demand-side investments are undertaken. The commissions should also ensure that the integrated resource plan of the states would also be profitable to the utilities. This means that a specific cost recovery mechanism for the utilities may be provided for initial costs. Without this cost recovery mechanism, full-scale implementation would be delayed for years, as has been the case for DSM efforts in other Asian countries.8

Recovering Programmes Costs: Rate-Basing vs. Expensing of DSM Costs

When a utility encourages its customers to conserve energy by offering incentives (information, rebates etc.), it incurs cost that need to be fully and promptly recovered just as utility recovers supply-side investments. There may be two methods for utilities to recover supply-side or demand-side costs: they can be expensed, or rate based. Costs that are expensed are recovered in

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the year in which the expenditure is made. Costs that are rate based are recovered over time, with a rate of return (i.e., profit). Utility investments in generation, transmission, and distribution systems are generally rate based, while DSM costs have tended to be expensed.

By rate-base DSM expenditures and by decoupling utility revenues from sale, supply-side and demand-side investments may compete on a more equal basis. However, it can be argued that DSM needs more than that if it is to fulfill its potential of delivering energy services at the lowest cost.

The most popular mechanism, which was adopted by California's utility to allow the utility to profit from DSM investments have been explained here as main example of successful DSM programme. This approach was commonly known as, shared saving programmes. Under this programme, the utility and the rate payers shared the benefits of saving energy through the utility's DSM investment and utility earnings incentives have been tied to the amount of money actually be saved by conservation. This programme has led to PG & E's (California's utility) significant increase in DSM activities in the early 1990's.

This programme was based on the following simple equation.

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\text{Net Saving (Rs.) = Avoided Cost (Rs.) - Programme Cost (Rs.)} \quad \ldots 5.1
\]

Where:

Avoided Cost (Rs) = Load Reduction (KW or kwh) x Avoided Supply Cost (Rs/ KW or Rs/kwh)

Programme Cost = Utility Efficiency Programme Cost (administration, rebates, etc.)

In the utility’s shared saving programmes, the utility’s shareholders have been allowed to keep 15 percent of the net savings as their incentive to invest in DSM provided that certain target for energy savings have exceeded. There was also a 15 percent penalty that was applied to the shortfall if savings drop below a separate minimum threshold. Performance has been measured by programme participation, not by programme energy savings. The remaining 85 percent of the net savings benefited the ratepayers as a whole through reduced costs of utility energy generation. Ratepayers who have taken advantage of the rebate also saved on their electric bills since they have been using less electricity. It has been explained with the following example.

Suppose that utility offer a Rs 100 rebate on 18 watt compact florescent light bulb (CFLs) that produce as much light as 75 watt incandescent bulb and which lasts 10000 hours. Suppose it costs the utility an additional Rs 1 per CFL to administer the programme. Also suppose the utilities (avoided) marginal cost of electricity is Rs 2 / kwh. If 1 million consumers take advantage of the
rebate, the allowed earning for the utilities share holders will be as given below:

The avoided cost to utilities would be:

\[(75-18) \text{ Watt} / \text{CFL} \times 10000 \text{ hr.} \times \text{Rs } 2/\text{kWh} \times 10^6 \times 10^{-3} \text{ kW} / \text{W} = \text{Rs. } 1140 \text{ Million.} \]

The programme cost would be \((\text{Rs } 100 +1) / \text{CFL} \times 10^6 \text{ CFLs} \) = 101 Rs Million.

The net saving would be Rs 1140 – 101 = Ra 1039 Million

The share holder benefit would be 15 percent of Rs1039 million =155.85 Million

The net saving to ratepayers would be 85 percent of Rs 1039 million = Rs 883.15 Million.

Thus it is clear from the above that much of the experience of developed countries in the utilities driven demand side programmes may be transferred to developing countries as well.

C. ROLE OF UTILITIES

Electric power utilities have an important role in promoting DSM programmes. They have greater potential to overcome market barriers than other institutions usually do, as distribution utilities are in constant contact with end users. They know who their customers are, know their energy consumption habits, have well-established payment collection mechanisms at hand, are in a position to collect and analyses data, have technical know-how etc. It is also easier for them to provide incentives through the monthly electricity bill and
the selection of technologies that optimize the system's load factors. Furthermore, they can translate the avoided costs for new capacity into lower tariff rates for consumers.

The above factors show that there are several advantages of designing energy efficiency programmes by the utilities in comparison to other institutions. For this purpose, a demand-side management cell may be set up in the utilities, which may start its functioning with information dissemination activities by organizing workshops, meeting with consumer forums, and dialogue with manufacturers on how to increase energy efficiency in all spheres with economic activity in the state.

Simultaneously, the utilities may take steps to develop a comprehensive DSM programme by providing an appropriate financial package along with every DSM option. The financial incentives may include: initial capital subsidies, low interest credit schemes, accelerated depreciation, tax rebates, sale of equipment at a specific price directly by the utility and financed over time with installments collected together with their electricity bills, installation of a limited number of equipment per home and adoption of a discount system to reward energy savings etc.

Since in Haryana agriculture and domestic sector are receiving heavily subsidized electricity and account for nearly two third of the power consumed
in the state, it may be obvious priority area for energy-efficiency efforts and the strategies may concentrate on these two sector to optimize results.

**Financing DSM Programmes**

DSM programmes are expected to encounter several problems during its implementation. Primarily, there may be financial hurdles and the constraints of a regulated economy. The main financial barriers may be lack of funds, lack of skill and resources. This has been discussed in detail below.

**Lack of capital**

Investment in energy efficiency requires a considerable amount of funds. The customers are unable to finance these investments at their own self. As already stated that residential customers may not afford DSM because of the high initial monetary outlays associated with the purchase of efficient measures. In the agriculture sector also, it may be unreasonable to expect the farmers to purchase new efficient agricultural pump sets, since most of the farmers may not have such capital at hand. Thus, the capital crunch extends beyond just the end user.

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New Sources of Capital

Since, there may not be enough capital in any of the customer categories to finance these investments, a new approach to financing needs to be developed, which taps funds from unconventional sources. The private sector may play increasingly important role in promoting energy efficiency, with the liberalization efforts of the Indian economy. Therefore, DSM programmes may be designed with maximum involvement of the private sector. Some of the options have been proposed as under.

Vender Financing

One of the options may be through Vender Financing. Manufacturers of the energy efficient products are in a better position to get a loan from the financial institutions as compared to customers. The vender may finance the leasing of the equipment to the customer, through a contract with a financier. The customer would make lease payments to the vender, and the vender would meet the financing repayment terms of the financier. In this way, the financier has a better loan proposition, the vender makes his sale, and the customer is able to afford the new technology.

Direct installation/ Energy Service Company (ESCOs):

Another options may be through energy service companies, who may offer a single point service to the consumer, by providing technical, financial
and managerial expertise. Energy Service Company may take up the programme and implement it. A few large-scale operators or a large number of small operators in block or district levels may take up the programme. The operation of the ESCOs for agriculture sector in the state through a proposed DSM scheme has been elaborated below.

**New pumps for Old and Free**

In this scheme, the farmer would be offered brand new, state of art, pumping system “free of cost” in exchange of the old and inefficient one. These new systems would be of smaller horsepower but would deliver the same quantity of water as before. The old pumps, motors, foot valves etc. would be physically removed and destroyed.

**Payback**

The utility would not invest any money in this mechanism and a private party (ESCO) would make the entire investment. The utility would allow the private party to demonstrate the savings and based on the savings would allow the private party to keep the entire savings for some predetermined periods. This savings would be paid out on a monthly installment basis for this period to the investors.
Operational Modality

Different areas would be earmarked for ESCO operators. He would collect the list of participants from the local authority / office of the utility. He would be responsible for implementation of the programme in that area. The different steps involved in implementation of the programme would be as follows;

Awareness Creation

The ESCO operator has to organize meetings of farmers where they would be enlightened about the programme and the need for implementation of such a programme. They would also explain the advantage of such a programme.

Organization Development

For implementation of a successful programme a proper organization has to be set-up. There should be enough of expertise within the organization not only about the energy conservation and related aspects but also about water requirements for different crops, etc. the organization should have right kind of people to carry out the training programmes, implementation of the schemes, supervision of the programme, operation and maintenance of the equipment, etc.
Procurement of Material

The ESCO would be responsible for drawing up the technical specifications, selection of the proper pump sets, pipes, foot valves, etc. They have to work out the delivery logistics, inventory management, transportation of the pumps to the site, etc.

Identification of End User

A list of the farmers having pump set connection may be collected from the utility office, which serves as a starting point for the implementation. After the awareness creation programme, the consent of the farmers would be collected in writing, where some basic data like head, type of water source, water requirement, cropping pattern, etc. may be collected. This would act as a basic document for placing the orders for the pump sets and implementation of the programme.

Programme implementation

A team of technician would take the required materials to a village and install the pump sets removing the old pump sets should be collected by the ESCO and should be physically destroyed. After the installation of the new set, they would hand over the set to the farmer and the farmer would acknowledge the receipt in writing. The ESCO would be paid based on these letters
Programme Monitoring

The utility may set up an independent agency to monitor the implementation programme. The monitoring team may check up the implementation of the programme by visiting an installation in each village and talking to farmers. Based on their feedback, the ESCO may be paid.

Operation and Maintenance Network

The ESCO should also set up Maintenance cell, which would take care of the maintenance of the pump sets. The ESCO should give two years guarantee for the pump sets, during which period all maintenance and repairs should be done free of cost. Afterward they may charge the end user on call basis.

The ESCO should have a proper organizational set up for this so that minor problems should be attended to within 2-3 hours and major ones within two days. They have to train the local village technicians to attend the minor problems. They should have a full-fledged service center for 4-5 villages, so that major problems may be attended to without much delay.

As the local technician would involve in the designing and implementation of the programme, it is important that he would aware of the proper designing of the system. They should be enlightened about the seriousness of the problems involved, and be given proper training
Financing of ESCO

There are two different schemes that may be adopted for financing the ESCO. They are:

a. Payment by utility based on energy saving

In this case, the utility would share the income with the ESCO based on the saved energy, which may be sold to the other end users, predominantly to the industrial sector that has higher tariff. Thus, in the process the utility will be trying to reduce the sale of cheaper and at the same time increasing the sale of costly power. This would also reduce the transmission losses and thus the energy sold would be more than the energy saved in the agricultural sector. This system would offer greatest potential for the utility for energy savings.

b. ESCO acting as a “dealer” of power supply in a feeder.

Under this scheme, the utility would sell the energy to the ESCO at a predetermined rate. The ESCO in turn would sell this energy to the different end users in its jurisdictions and would take care of the bill collection also. This would be the cash inflow to the utility. Thus, utility would act as a “dealer” of the grid in supplying the energy in a particular region.

Leasing Arrangements

The government of India allows 100 percent depreciation of the investment on energy efficiency systems. Thus, the ESCO may make use of this, channeling the procurement through a financial institution. The financial
institution may absorb a portion of the tax credit and pass on the balance to the ESCO. Thus the cost of the equipment to the ESCO may be reduced. This would also helps the ESCO in matching its cash in-flow and cash out-flow, as there would be cash in-flow to ESCO from the utility.

Thus, it is clear from the scheme elaborated above that in this type of schemes, the ESCO would invest its resources and the utility would monitor the savings. Similar scheme may be adopted to facilitate the improvement in energy efficiency in all the sectors through the route of ESCOs.

The main advantages of such a scheme would be:

1. The ESCO may operate more efficiently than the government owned utility.

2. The consumption of subsidized sectors would reduce and the higher paying sectors would increase consumption, resulting in increase in revenues to the utility.

3. After a few years the utility, the customer, and the ESCO would be better off and the nation would have saved valuable energy.

Hence, it is proposed that ESCOs may be encouraged to venture into this area because they may be bearing all the risks and would be getting paid only from demonstrated savings. Such companies may also be provided necessary government support through suitable policy initiatives / fiscal benefits.