Agricultural DSM in India: Overview and Way Forward

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Abstract- India is gifted with a rich and vast diversity of natural resources and water is one of them. It plays a vital role in agriculture production. The pumping of ground water to irrigate crops consumes about 50% of the ground water resources and around 35% of the electricity generated in the country. In order to meet the growth target for power availability, its entire requirement cannot come solely from generation augments. A major contribution will have to come from savings through better demand side management and improvement in the end use efficiency. As agriculture sector is one of the unorganized sector and inefficient power users in India, it may provide immense opportunity to save energy through better demand side management techniques. The paper is mainly focussed on the importance of the agricultural demand side management and different businesses models for energy efficiency improvement in this sector.

Keywords – Agriculture, Pump, Electricity, Demand, Security

I. Introduction

The Indian agriculture sector along with its associated sectors is indisputably the largest livelihood provider in the country. It ranks second worldwide in the farm output. The GDP of agriculture sector and its allied sectors in India reached US$ 151.8 billion in the FY 2012. Basically, it is the dominant sector of Indian economy which determines the growth and sustainability in the country. In the past few years, Indian agriculture sector has done remarkably well in terms of output growth. The 11th Five Year Plan (2007-2012) witnessed an average annual growth of 3.6% in the GDP from agriculture and its allied sectors. The growth target for the agriculture sector in the 12th Five Year Plan is estimated to be around 4 %.

In order to boost this agriculture sector from different perspective, Government of India has already initiated different schemes all over the country. Demand side management is recognized as one of the important area in the agriculture sector in view of the increasing energy consumption pattern and need to be considered as key strategies capable of offering unique opportunities to implement energy efficiency measures. Energy efficiency through agriculture demand side management promises immense opportunities and benefits. Agriculture demand side management programme of Bureau of Energy Efficiency could offer a unique way to influence and change the equipment buying habits of end use consumers so that they prefer to adopt efficient technologies. The benefits are realized through reduction in overall power consumption, improving efficiencies of ground water extraction, reducing subsidy burden on state utilities and also investment in power plants through avoided capacity. The studies undertaken by Bureau reveals that the current efficiency level of pump sets are in range of 20-25% and efficiency improvements can reach up to 40-50% for existing pump sets as well as for new pump sets which would be installed. Overall, Pump set efficiency up-gradation is one the key aspects of DSM measures in agriculture sector.

II. Electricity and Agriculture sector

Electricity is the primary source of energy in Indian agriculture pumping sector. The Indian agriculture sector is the third highest consumer of electrical energy with a total consumption of 92.33 billion kWh in 2007-08. It accounts for 19% of the overall electricity consumption level of the total electricity supplied in the country. The total operating pumps in the country is something around 18 million and also every year addition of 0.5 million new pump sets is realised in the agriculture sector. The pump sets which are now being operated are very low efficient pumps sets (20-35%) and are available in the market at a low price of less than Rs 15,000. Various
pilot studies undertaken by World Bank (2001), WENE XA (2007) have also witnessed the poor level of efficiency of these agriculture pump sets. A recent study by NPC estimates a total saving potential of 27.79 billion Kwh in Indian agricultural pumping sector. This accounts for 37% of the overall energy saving potential and about 40% of the overall energy deficit reported in the country during 2007-08. So it’s quite obvious that there exist a huge potential for energy savings in agriculture sector through DSM activity. So, realizing this opportunity some national level project need to be efficiently implemented so that the savings in a greater amount can be realized. Twenty five years ago electricity sales to irrigation pump set consumers was less than 10% and today it is something around 20%. Therefore, managing this agricultural load now is a key challenge to all electric utilities in India.

III. Demand Side Management (DSM)

DSM is basically a concept in which the power utility plans, implements and monitors the different activities which have been designed to encourage the customers for improvement in their electricity consumption patterns, both with respect to timing and level of electricity demand so as to help the customers to use electricity more efficiently. It basically manages the demand for power among the customers to meet its current or future needs. DSM is either implemented directly through utility sponsored programs or through market intermediaries like Energy Service Companies.

For agricultural sector particularly, utility DSM is highly beneficial because of the subsidized prices and high costs of supply resulting from technical and commercial losses. At the same time, DSM helps industries to be placed more competitively in increasingly open markets in the age of globalization.

IV. Agriculture Demand Side Management (AgDSM)

The agriculture sector in India uses 85% of the available fresh water. However, on-farm irrigation efficiency is only 20-50%. The other 50-80% is wasted. Combining these data indicate that the agricultural sector in India is wasting from about one half of the country’s total fresh water supply. On the energy front also there are inefficiencies as well. The electricity is largely used in agricultural pump sets which generally have very poor efficiency. Since agricultural tariffs are usually the lowest and also highly subsidized, there is no incentive to the agricultural consumer to improve efficiency of the pump set. However, utilities are not able to recover economic price on every unit of energy sold to these categories of consumers and therefore need to aggressively target these consumers for DSM measures. Ag DSM promises immense opportunity in reducing the overall power consumption, improving efficiencies of ground water extraction and reducing the subsidy burden of the states without sacrificing the service obligation to this sector.

For developing the market of energy efficient pump sets we need to come up with various strategies. The present market for energy efficient pump sets is very small and there is need to identify what could be the barriers and what keeps the consumers as well as manufacturers away from energy efficient pumps market to target new consumers.

Although many of states are coming up with various schemes to promote the usage of energy efficient pump set but there is lack of involvement from both farmers as well as the implementing agencies/manufacturers. Also the pump manufacturing sector is quite unorganized, and only 64 companies are accredited/Members of Indian Pump Manufacturers Association (IPMA). For the development of the market for energy efficient pump sets there are four pillars (Fig 1) which is highly recommended, otherwise there are lot of chances to meet the failures during the implementation.

![Figure 1: Four pillars for creating market for energy efficiency](image-url)
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The following are the main factors which need to be considered for the development of a market for the energy efficient pump sets in the country.

4.1 Innovative incentive scheme for the Pump manufacturers: Today there are very few pump manufacturers who are manufacturing star labeled pump set. The key reasons are the manufacturing cost of such pumps which is higher (around double) than the conventional pumps. And the other reason is the low market demands which somehow discourage the manufacturers in going for manufacturing of energy efficient pump sets. Incentives could be one of the beneficial options to overcome such type of barriers. One way of incentivizing could be providing tax exemption to manufacturers of energy efficient pump sets which would encourage the manufacturers to go for energy efficient pump market.

4.2 Creating a market for the energy-efficient pump sets: Due to high Cost of energy efficient pumps people are reluctant to spend their money on energy efficient pump sets. Awareness for energy efficient pump sets and providing some financial assistance to the buyers also may be one option for increasing the demand of energy efficient pumps.

4.3 Benefit to all stakeholders: For any market to be successful there should be an easy flow of money and there should be profit realization at both the ends i.e. manufacturers and consumers. Savings through energy efficiency is not directly realized at the consumer end but it is realized by DISCOM (Distribution Companies) or power generating companies because here the consumers are mainly agriculture sector consumers and they are charged flat on HP rating not on units consumed. So, there should be appropriate flow of money for installation as well as profit realization through project to all the stakeholders.

4.4 Government Support for promoting energy efficient pump-sets: To develop any kind of market in any country initially requires support from the government and its allied institutions. The best solution is to simply regulate the energy market and allow the market to deliver the energy efficiency as a result without compromising the other parameters. But such approach generally fails because of two reason lack of awareness of energy efficient equipment on consumer side and other is the technical capacity of industries. Thus, there is need for deliberate effort form government/utilities to reduce such type of market barriers and also need to look at the innovative kind of investments approaches for creating an energy efficiency market.

V. Opportunities of AgDSM in India

The objective of the Ag-DSM programme of Bureau of Energy Efficiency is to reduce energy consumption of the sector through policy initiatives and implementing few pilot projects on Public Private Partnership (PPP) where in-efficient pump sets are replaced with star rated energy efficient pump sets. The primary beneficiary of this program will be the state governments that provide financial support to the utilities for subsidizing electricity tariffs in agriculture pumping sector. Significant reduction in state government subsidy for agriculture pumping will allow the governments to channel the funds to other social sectors including education, primary health and rural infrastructure. The Ag DSM scheme of BEE is currently initiated with pilot scale demonstration projects in 11 DISCOMS of 8 states which are agriculturally intensive and covering around 20,000 pump sets, accounts for more than 70% of electricity consumption in this sector. Energy Audit of these pump sets on around 87 feeders has been done and around 40% energy saving potential with a payback period of 3-4 years has been assessed.

![Energy Saving Potential in different part of the country](image-url)
VI. Business models

There are different types of models that have been developed for the implementation of energy efficient pump sets through agricultural DSM scheme of Bureau of Energy Efficiency. The models are:

1. DISCOM Mode

In the DISCOM mode, the project is financed by a DISCOM. The implementation is carried out by an ESCO. DISCOM utilizes a part of Load Management Charge (LMC) Fund collected under a tariff regulation for replacement of old inefficient pumps with a new higher energy efficiency pump sets. Under this mode the repair and maintenance of pumps and certain aspects of project works is contract out to a project contractor. The overall model is shown in Fig. 3.

2. ESCO Mode

Under this mode, the ESCO has a contract with DISCOM for financing and the implementation of the project; the ESCO would borrow the project debt and repay it from the project revenues. The overall model is shown in Fig. 4.
3. Hybrid Mode

ESCO provides part of project funds through debt & equity and sign a contract with DISCOM, whereas part of the project fund would be contributed by DISCOM through LMC fund. The overall model is shown in Fig. 5.

![Diagram of Hybrid Mode](image)

VII. Barriers/Challenges in the pilot AgDSM projects

There are several barriers which are being faced during the implementation of this agricultural demand side project in India. Some of these are:

- Farmers are very reluctant towards reducing their pumps HP rating
- Farmer are also afraid of metering of the electricity consumed
- They are reluctant towards the signing of the contract agreement with the Energy Service Companies
- Pump ownership with 2 - 3 families is one of the biggest hurdles for entering into pump replacement agreement.
- Pump replacement is taking time as individual farmers have to sign the agreement.
- Low voltage issues in most of the states.
- Some existing pump-sets are over loaded and to meet the discharge, implementing agency need to select Higher H.P pump-sets
- Improper pumping systems leads implementing agency to change the entire system along with all the accessories to achieve the guaranteed power savings. Ultimately this leads to increase in the cost of the Project.

VIII. Way Forward: An urgent need

- Facilitate State Designated Agencies/State governments to mandate the use of star labeled pump sets.
- Integration of Ag-DSM Scheme with existing State/Central government schemes in agriculture sector to promote the adoption of energy efficient star rated pump sets.
- Designing of a strong Monitoring & Verification protocol for capturing the real energy savings.
- Technical assistance and capacity development of all stakeholders i.e. SDAs, SERCs and DISCOMs.
- Open house session for farmers to increase awareness and encourage their participation in Ag DSM scheme
• Efficiency up-gradation of rural drinking water pumping systems.

IX. Conclusion

Implementing Agricultural Demand-Side Management (AgDSM) is very important for improving financial health of most of the distribution utilities in India since these utilities sell significant amounts of power to the agricultural consumers at subsidised rate and in return they don’t even get the cost of generation per unit. At the end of the 12th Five Year Plan, it is forecasted that through market transformation of agriculture pump sets, major manufacturer of agriculture pumps in the organized SME sector would transform into manufacturing of energy efficient star labelled pumps through the various initiatives of Government of India.

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