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Agricultural Demand Side Management (Ag-DSM) Program in India

Adopting Technologies to Boost Efficiencies



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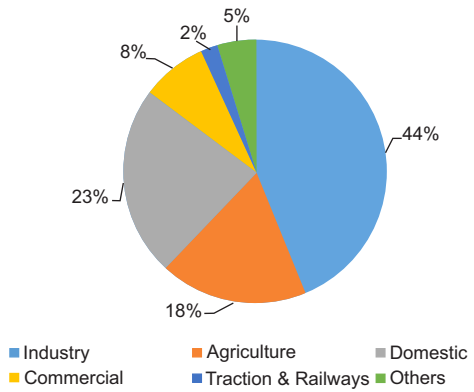
Adopting Technologies to Boost Efficiencies

Indian Scenario:

Agriculture sector is one of the most important sectors of the country as it accounts for **18% of the nation's GDP** and engages about **49% of the nation's workforce**. Hence, it has always been a focus area of government to accelerate the growth of agricultural production in order to improve not only the productivity of the sector but also the income of the large manpower dependent on this sector for their livelihood. Though the sector has grown by about 1.1 % in 2014-15, it is still behind the growth rate of 4% per annum as desired in the 12th Five year plan (2012-17)[1].

As a result of the focus to improve the sector's productivity, the energy demand in agriculture sector has increased tremendously and has led to increase on the pressure on the nation's energy resources. India's agriculture sector consumes about **170 Billion Units (BU)**[2] of electricity which is equivalent to about **18% of the total National Electricity Consumption of India**. The electricity

Figure 1: Sector wise Electricity Consumption in India (2014-15)



Source: Energy Statistics 2016, MOPSI

[1] *Planning Commission Report, Government of India, 2015*
[2] *Energy Statistics 2016, MOSPI, Government of India*

consumption in agricultural sector has been almost doubled as compared to the consumption in 1970s. The rapid increase in electricity consumption of the agricultural sector is largely due to growth of rural electrification as well as various benefits being provided to farmers in the form of electricity subsidies and free electricity for their agricultural loads. According the Central Electricity Authority (CEA), there are about 20.27 million electrified pump sets installed in agriculture sector. Further, due to the increasing demand for water to meet the agricultural needs, about 0.25 to 0.5 million new pump sets are being added annually.

Typically, the pump sets used in agricultural purposes are inefficient in terms of overall energy performance. The low energy performance is typically caused by low pump efficiency, over/under size of pump, improper preventive maintenance practice, and power quality issues. This is largely due to the fact that the users receive almost free electricity and so are not motivated to improve energy performance by purchasing efficient pump sets (which are more expensive than the standard pump sets) or by adopting other best practices, such as proper pump selection, preventative maintenance, and efficient water use. As a result, the state government incurs a huge financial as well as energy loss due to this wide use of inefficient pump sets. While the average efficiency of these standard installed pump sets ranges between 25% and 30%, the energy efficient pump sets, as per Bureau of Energy Efficiency (BEE) star labelling, have energy efficiency levels as high as 50 to 60%. Hence, there is an **estimated saving potential of about 25% to 30%** by simple replacement of the existing inefficient pump sets with BEE star labelled efficient pump sets. In addition to this, going for reduction in the specific energy consumption (kW/litre per second of water) could also provide an **additional 5-10% energy savings**. Additionally, this may also reduce the maintenance as well as repair costs incurred by the farmers as the breakdown frequency decreases drastically provided a minimum preventive maintenance practice is adopted and good power quality is ensured.

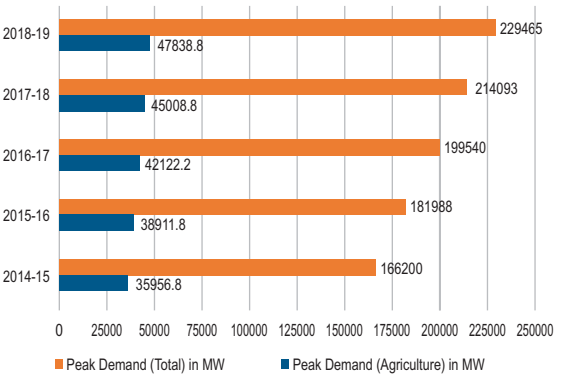
Table 1: Analysis of Pump set Efficiency Potential

Particulars	Unit	Value
Total Electricity Consumption in India	BU	950
Electricity Consumption by Agriculture Sector	BU	171
% Electricity Consumption by Agriculture sector	%	18
Average installed capacity	kW	7.5
Average Annual operating hours	Hours	1800
Total number of pump sets	Million Nos	20.27
Average annual consumption per pump	kWh / pump / year	13500
Average saving potential per pump	%	25
Average annual saving potential per pump	kWh/pump	3375
Total Energy Saving	BU/year	68.41
Total Saving (@ Rs. 4.50/kWh)	Billion Rs	307.85
Assuming replacement of all the pump sets		
Approximate overall cost for efficient pump set	Rs. / pump	**45000**
Total Investment estimated	Billion Rs	912.15
Simple Payback period	Years	**2.96**

Source: ICF analysis based on CEA Energy Statistics

As per the study conducted by the Forum of Regulators to develop strategy for providing 24 x 7 power supply to all[3], an important option to reduce peak demand is **replacement of existing agricultural pumps with efficient pumps**. It was seen that this replacement program could avoid about **10,000 MW of generation capacity.**

Figure 2 : Estimated Peak Demand Trend (2014-2019)



Source: Forum of Regulators, Dec 2014

Considering this trend, a complete replacement of all the existing agricultural pumps to efficient pump sets by **2019** shall ensure a **reduction in the peak demand by about 21%.**

Hence, Agriculture sector needs to be focussed in terms of Demand Side Management (DSM) measures due to the above mentioned reasons such as dominant consumption of electricity (primarily met by fossil fuel based thermal power generating plants),

[3] *Forum of Regulators Report, Dec 2014*

subsidized tariff, contribution to peak demand etc. As there is no incentive for agricultural consumers to improve efficiency of the pumping system, other stakeholders must be involved in implementing these DSM measures in order to improve the productivity as well as to reduce the energy demand.

Interventions in Agricultural Sector:

Even though the sector contributes about 18% of the total electricity consumption of the country, in terms of revenue realisation, the electricity sale to this sector hardly amounts to **5% -10%**[4] of the overall revenue of Electricity Distribution Companies (DISCOMs)'. In addition to this, it is clear to all that the underground water sources are depleting at an alarming rate and various benefits in terms of free or low cost electricity supply to this sector has aided this depletion process. Hence, there is a need to have a holistic long term result oriented strategy to control both these situations without affecting the livelihood of a large segment of the population.

Agriculture Demand Side Management (AgDSM) helps in influencing the nature and behaviour of the consumers and thereby modify their consumption pattern which is more beneficial to both the nation's resources as well as DISCOMs. Replacing old inefficient pump sets with new energy efficient pumps sets not only helps in reducing the overall energy demand and specific energy consumption of the equipment, it also gives a net economic gain both to the consumer (since pump lifetime will be longer and downtimes shorter) as well as the other stakeholders. Fitting pumps with timers, or other control mechanisms, helps control water consumption and prevent depletion of water resources.

Over the last few years, various DISCOMs, under the guidance of BEE and support of Energy Efficiency Services Limited (EESL), have implemented various AgDSM pilot projects with an aim to identify a

[4] *Factsheet on AgDSM, PIB, MoP, 2015*

possible solution to this persistent problem. As a part of these efforts, the Ministry of Power had initiated the AgDSM program of replacing the inefficient pump sets on **Public Private Partnership (PPP)**[5] mode through BEE during the XI plan period. In the program, about eleven DISCOMs were targeted which were located in eight agriculture intensive states namely **Maharashtra, Haryana, Punjab, Rajasthan, Gujarat, Andhra Pradesh, Madhya Pradesh and Karnataka.** This study covered around 20,000 pump sets across these states and eleven Detailed Project Reports (DPR) were prepared. These DPRs covered various major aspects such as baseline estimation, energy saving potential assessment, risk mitigation measures and cost benefit analysis. The major impact of these DPRs was that it identified **an average energy saving potential of about 40% with a simple payback period ranging between 3 to 4 years.**

On the basis of these DPRs, various business models were developed to execute these pilot projects in these eight DISCOMS. The models identified were:

i. **DISCOM Model -**

   DISCOM invests its own funds to replace the pump sets with support from pump manufacturers and project contractors

ii. **Energy Service Company (ESCO) Model -**

   Here, ESCO has a contract with the DISCOM and invests its money and earns back from the DISCOM through Energy savings obtained or estimated through an agreeable methodology.

iii. **Hybrid Model-**

   The project is jointly funded by both DISCOM and ESCO and the ESCO earns back a portion of the energy savings as per their contract.

Based on the DPR findings, four pilot programs have already been implemented in the states of Maharashtra, Andhra Pradesh and Karnataka. The broad findings of these programs are as follows

[5] *BEE reports on AgDSM*

Table 2: AgDSM projects implemented in India[6]

DISCOM	State	Number of Pumps targeted	Energy Savings achieved
MSEDCL	Maharashtra	2209	25%
HESCOM	Karnataka	590	37%
CESCOM	Karnataka	1337	37%
APEPDCL	Andhra Pradesh	2496	28%

In addition to this, various state governments as well as their regulatory authorities have taken various initiatives to promote AgDSM in their respective states. Some of the initiatives are

Table 3: AgDSM initiatives by various State Governments[7]

States	Initiatives
Haryana	✓ Mandatory use of Efficient pump sets ✓ Financial Assistance for Adoption of Efficient pump sets by HAREDA
Punjab	✓ Mandatory use of Efficient Pump sets ✓ Notification by PSERC for implementation of AgDSM initiatives
Rajasthan	✓ Financial Incentive of for adoption of Efficient pump sets
Chhattisgarh	✓ Rebate in electricity bills for adoption efficient pump sets
Karnataka	✓ Mandatory use of efficient pump sets
Gujarat	✓ DISCOMs in process of implementing AgDSM measures as per DSM regulations

Major Stakeholders Involved:

Implementing a successful AgDSM program depends on active participation of the various stakeholders. In India, some of the major stakeholders involved are:

1. **Ministry of Power (MoP) / Bureau of Energy Efficiency (BEE):**

   BEE, the nodal agency under MoP to oversee Energy Efficiency and Energy Conservation activities in the country, has the responsibility to define the necessary policies and guidelines which would facilitate in bringing about a market transformation to enable the other stakeholders to execute AgDSM programs.

2. **Electricity Regulatory Commission (ERC):**

   Both the Central ERCs as well as State ERCs play a pivot role in reviewing the regulatory dimensions when a DISCOM plans to execute a program on AgDSM.

[6] *EESL Reports on AgDSM*
[7] *BEE Reports on AgDSM*

3. **Electricity Distribution Company (DISCOM):**

The DISCOMs are the agencies that would implement the AgDSM program in their respective regions as they would ultimately benefit in terms of energy savings. This may help the DISCOMs to reduce their revenue loss, earn extra revenue by diverting the saved power to premiere consumer category, lower the overall power purchase cost etc.

4. **Farmers:**

Though any AgDSM program is not economically lucrative to the farmers, they are the principal beneficiary of this program. A good AgDSM program may assure them longer pump life as well as lesser down time for their pump sets while meeting their water supply needs.

5. **State Government:**

State Government is a crucial entity to promote AgDSM schemes in the state as it spreads a positive message among the various stakeholders especially the farmers who need to be motivated to join such schemes.

6. **Pump Manufacturers:**

The Pump manufacturers play pivotal role in this program as they help the other stakeholders achieve the necessary energy savings by providing energy efficient pump sets and necessary technical assistance to the implementation of the program.

At present, there are about 266 Indian manufacturers producing the star labelled pumps in India. The overall production capacity of the manufacturers are about 5.1 million in various categories of pumps.

Table 4: Installed Manufacturing Capacity of Indian Pump Manufacturers[8]

Product Type	Star rated pumps produced/year	Approx. production/ year	Total present capacity
Mono bloc - 1 PH		900000	1800000
Mono bloc - 3 PH	100000	350000	700000
Open well Submersible	125000	350000	700000
Submersible Pumps	150000	900000	1900000

[8] *Indian Pump Manufacturers' Association (IPMA) data*

7. **Energy Efficiency Services Ltd. (EESL):**

   EESL, a Ministry of Power entity established as a joint venture of PSUs of the ministry, has the mandate to implement large scale AgDSM programs in India in collaboration with DISCOMs and State Governments. EESL promotes this program as a principal investor which would be paid back by DISCOMs in a phased manner from the energy saving achieved or realized on a deemed saving approach.

8. **Other Energy Service Company (ESCOs):**

   Apart from EESL, the other ESCOs are also important entity as they help in financing these AgDSM programs for various DISCOMs who do not have the adequate financial budget to execute these programs independently preferably small/medium scale programs.

9. **Panchayat / Block Level Departments:**

   The involvement of the various departments at the Panchayat as well as Block level are required in order to execute the AgDSM program successfully as they can help the program reach out even to the most rural areas of the country.

10. **Financial Institutions:**

    Various Financial bodies act as both a guarantor for the DISCOMs for these AgDSM programs in case of ESCO business model and also provide financial loans / debts to DISCOMs to execute these projects independently.

11. **Project Management Contractors (PMC):**

    The project management contractors are essential to ensure that the AgDSM programs are executed systematically as well as managed and completed within the defined time period for the program.

[4] *Factsheet on AgDSM, PIB, MoP, 2015*

12. Other Relevant Ministries & Departments:

As this program primarily aims to improve the agriculture sector as a whole, the involvement of other Ministries such Ministry of Water, Ministry of Agriculture, Ministry of Irrigation, related state level departments, etc., are crucial as they need to develop policy guidelines that facilitate the AgDSM program.

The involvement of all these major stakeholders is necessary to develop a sustainable AgDSM program in the country.

Barriers & Challenges:

As already discussed, implementation of AgDSM program promises a lot of benefits for all its stakeholders. However, there are various barriers and challenges that exist at present which needs to overcome in order to realise the actual benefits of the program.

These Barriers can be categorised into two sections

1. Institutional Barriers:

- Limited synergy between departments and ministries related to Agriculture, Water, Irrigation and Power.
- Limited Policy dialogues at national and state level on sector reforms regarding developing an integrated energy and water DSM framework for agriculture
- Unsuitable energy pricing and lack of water pricing for agriculture sector
- Absence of fiscal incentives for DISCOMs to go for DSM investments.
- Low encouragement for R&D institutes in developing super-efficient agriculture technologies especially for pumps.
- Limited or no tax incentives for manufacturing efficient pumps
- Limited state level regulations to mandate use of energy efficient pump sets and enforcement mechanisms
- No state level policies to encourage purchase of efficient pump sets.

2. Market based Barriers:

- Lack of awareness of importance of DSM by the DISCOMs
- Lack of decimation of successful pilot models implemented in the past
- Fear of loss of agricultural productivity by farmers
- Limited or no knowledge about Energy efficient pump sets.
- Unavailability of local technology / service provider for energy efficient pumps and other accessories
- No clarity on financial commitments by end users under ESCO mode.
- Limited usage of ESCROW account in India
- Limited availability of capital to invest in AgDSM projects
- Lack of knowledge of best agriculture practices despite use of energy efficient technologies.
- Inability to provide good power quality to agricultural feeders.
- Limited availability of resources to execute AgDSM projects in a programmatic model.

Hence, there needs to be initiatives taken to overcome these hurdles in order to implement a successful AgDSM program on a large scale.

Way Forward:

AgDSM program is a critical activity as far the nation's growth and energy security is concerned. It is time to accelerate this program on a large scale so that the true benefits of the program can be achieved.

In order to accelerate this program and transform it into a nation-wide program, many key steps need to be taken in this regard

- Creation of a business model similar to the DELP (Domestic Efficient Lighting Program) scheme for large market transformation.
- More dialogues and policy interventions by all the concerned

ministries such as Agriculture, Power, Water and Irrigation to promote this program for the successful implementation of the scheme.

- Establishment of a robust mechanism at the state level to ensure the use of BEE Star rated pump sets by all farmers.
- More active participation by the State government to overview implementation and enforcement of AgDSM programs in their respective states.
- Promoting more Pump Manufacturers to manufacture BEE star labelled pump sets to cater to the scale of a national program
- Provision of resources for incentives for manufacturing of energy efficient pump sets through some national funds such as National Clean Energy Fund, etc.
- Encourage R&D in this field through suitable collaborations and technology transfer
- Regulation should be in place to create separate DSM funds to enable DISCOMs to implement such DSM programs.
- Continuous Capacity Building of the various stakeholders to make them aware of the importance of the scheme.
- Outreach campaign to sensitize the consumers about opportunities for energy savings in agriculture sector and its impact in nation building.
- Development of robust Monitoring & Verification (M&V) protocols which are acceptable to all stakeholders.
- Active participation by various financial institutions in AgDSM programs in order to increase the availability of investment capital and to reduce few financial risks.
- Encourage more ESCOs, both national as well as international, to enter this market and provide the necessary support for them to function.

The CTCN Initiative:

Technology development and transfer have been identified as key elements to support nations in achieving their Intended Nationally Determined Contributions (INDCs). The UNFCCC Technology Mechanism facilitates climate technology transfer from developed countries to developing countries. Under the Technology Mechanism, the **Climate Technology Centre and Network (CTCN)** facilitates the transfer of climate technologies through providing: (i) technical assistance at the request of developing countries; (ii) access to information and knowledge on climate technologies; and (iii) collaboration via the Centre's network of experts from academia, the private sector, and public and research institutions. There is potential benefit to the AgDSM program from each of these three services.

Clean Energy and Climate Partnership between the Republic of India and the European Union

The European Union, which is a significant contributor to the CTCN, recognized the need to develop partnerships with India for the transfer, development and implementation of climate-friendly technologies in a joint declaration with the Republic of India[9]. Partnerships that could benefit AgDSM, potentially include collaboration between European and Indian manufacturers (for example, on expanding the manufacturing capacity on Energy Efficient pumps, on innovations in design and pump controls to be suitable for Indian power quality scenario), collaboration between European and Indian institutions on adoption of innovative financing models other than conventional ESCOs, as well as knowledge exchange between other Indian and European stakeholders.

[9] *Joint Declaration at 13th EU-India Summit, Brussels, 30 March 2016*



About FICCI

FICCI is the voice of India's business and industry. Established in 1927, it is India's oldest and largest apex business organization. It serves its members from the Indian private and public corporate sectors and multinational companies, drawing its strength from diverse regional chambers of commerce and industry across states, reaching out to over 2,50,000 companies.

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In India, ICF has worked closely with Bureau of Energy Efficiency (BEE), State Designated Agencies (SDA), Electricity Distribution Companies (DISCOMs), and Energy Efficiency Service Ltd. (EESL), etc as well as multiple industries on various Energy Efficiency and Demand Side Management (DSM) studies.

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